

Technology Review

A large crowd of people is gathered on the Berlin Wall, with the Brandenburg Gate visible in the background. The scene is set in Berlin, Germany, during the fall of the Berlin Wall in 1989. The crowd is diverse in age and appearance, and the wall is covered in graffiti. The Brandenburg Gate is a prominent landmark in the background, with the German flag flying from its roof.

EDITED AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

MAY/JUNE 1990

\$3.00

AFTER THE WALL

*Democratizing Science
in a New Germany*

ALSO:

EXTENDING THE LIFE OF NUCLEAR POWER PLANTS
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THE ARMS RACE MOVES TO THE THIRD WORLD
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OZONE UPDATE: IS THE TREATY WORKING?
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WHERE BICYCLES MAKE A DIFFERENCE
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technology review

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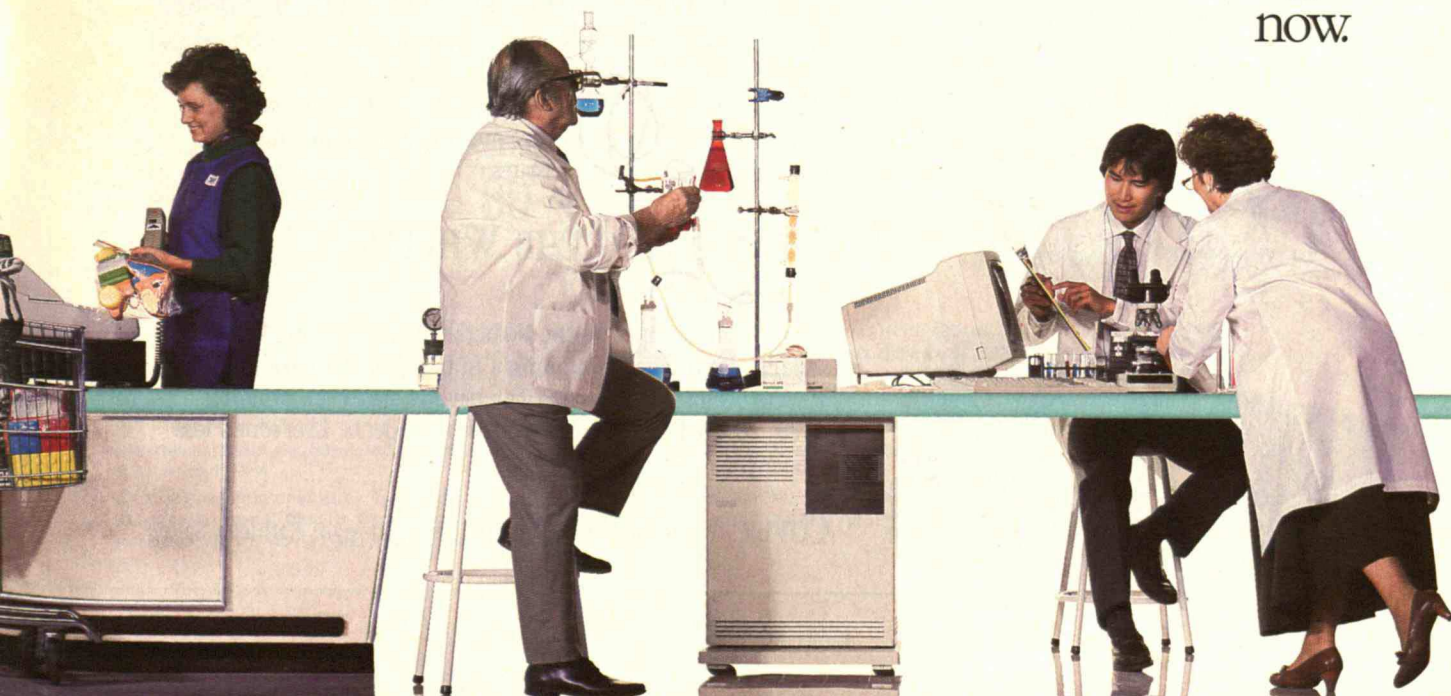
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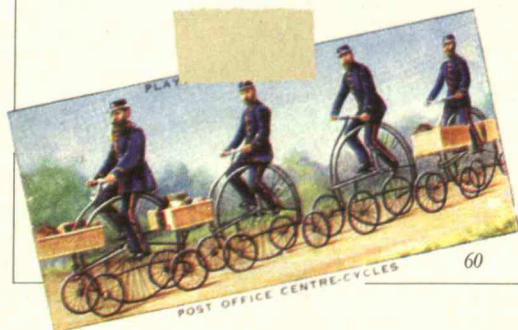
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COVER Photo: Robert Wallis/SIPA Press; Design: Kathleen Sayre

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"GO F



Marc Rankin
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The six people on this page aren't professional models or actors. They're part of the new Texaco. Their charge is this: if there's a better way to discover it, recover it, produce it, ship it or sell it... "go for it." For our part, we're eliminating the procedures and obstacles that can get in their way. The results have been

rather incredible.

"There's a tremendous team dynamic in the company now that we hadn't had before. You can actually feel the energy around here." Ron

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people together in one room, and we don't come out until the problem is solved. Now we're off the drawing board in three to four days." Kelly

"Our customers are being involved in the process, too. It's almost like we flip-flopped the corporate ladder. Instead of the CEO sitting on the top, the customer has

OR IT."



Bill Studzinski
Chemist

become the most important person. I think they're still a little amazed that we even *ask* for their input." Marc

"It's really paid off in our natural gas liquids business. We've quadrupled our customer base, and now we're a worldwide leader." Callie

"We're heading that way in

Carol Triebel
Superintendent, Planning and Shipping

fuels, too. Our new System³ gasoline has a lot of our competitors taking a second look." Bill

As you can see, there's a new energy at Texaco. We're aggressively searching for new oil. Getting more from our existing fields. Developing products for today that are designed to serve

Kelly Mayo
Systems Analyst

into tomorrow. And pioneering the clean energy sources that must guide us into the future.

"I'm glad to see Texaco taking a leadership role.

I'm really proud that I'm a part of it, too." Carol

So are we, Carol.
So are we.



TEXACO—WE'VE GOT THE ENERGY.

Ford Taurus SHO

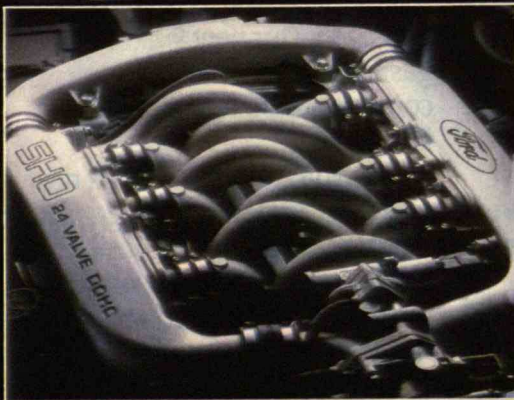
Think of it as the official pace car
of the *Fortune 500*.



The 24-valve, 220 horsepower Ford Taurus SHO.

With the coming of Ford Taurus SHO, the road to success has become much more exhilarating to drive.

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The Taurus SHO's specially designed interior is also dressed for success. Surrounding you with

Buckle up—together we can save lives.



appointments like fully articulated sport seats (leather trim optional) and new performance instrumentation, it offers the proper seating for those of your standing.

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Earth Day Revisited

ON Earth Day 1970 the "ecology" movement signified the need for society to reexamine not only its relationship with the human habitat but its most basic premises, particularly its insatiable desire for more cars, pesticides, smokestacks, pollution—more everything.

Leo Marx, a historian then at Amherst and now at MIT, traced the Western obsession with growth to the "aggressive, man-centered attitude toward the environment fostered by Judeo-Christian thought." He argued that the ecology movement accorded with an alternative pastoral tradition in American literature, the tradition of Jefferson and Thoreau, that distinguishes "between a commitment to unending growth and the concept of material sufficiency. The aim of the pastoral economy is *enough*—enough production and consumption to insure a decent quality of life."

A few scientists, such as Barry Commoner of Washington University and Paul Ehrlich of Stanford, spoke out about ecology, but the vast majority were silent, and the media rather freely adapted what it heard. "Scientists have solid experimental and theoretical evidence," proclaimed *Life*, that "in a decade, urban dwellers will have to wear gas masks to survive air pollution." Increased carbon dioxide in the atmosphere would lead to "mass flooding or a new ice age."

Two decades later, the scientific debate about the environment has progressed immensely, and technological advance looks more like the solution than the problem. Careful readers can glean a picture of what is and isn't known. Consider the vexing problem of global warming. We know that the amount of carbon dioxide and other "greenhouse gases" in the atmosphere has increased. Most climatologists believe this will raise global temperatures over the next century, but we know that they disagree as to how much. It could

be 0.5°C (manageable) or 5°C (ecological disaster). Local conditions such as increased rainfall, severe droughts, or intense storms will be what really matter, but these are even harder to predict than overall warming. We know that we may not know what we need to for many years.

Capitalizing on such uncertainty, the President's Council of Economic Advisors recommends that the nation wait and see what to do. But most technologists I know of believe the world should undertake serious efforts to curb greenhouse gases. MIT President Paul E. Gray and the new Brazilian secretary of

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than the problem.*

science and technology, José Goldemberg, concurred on this at a recent conference here on "Energy and the Environment in the Twenty-First Century."

That conference made clear the need for technological advance to help clean the environment. Some problems such as poverty, which grew worse in the United States and worldwide during the 1980s, result from the social and economic system. Other problems such as smallpox, which has been eliminated, are subject to a "technical fix." The environment may fall largely, though not completely, in the second category.

Consider the progress technology has already allowed the United States to make in preserving the environment. The higher the "energy intensity"—the amount of energy required per dollar of gross national product (GNP)—the worse the pollution. Energy intensity in the United States has dropped steadily since the 1920s. The energy crisis of the early 1970s issued a warning that we needed more conservation, and U.S. au-

tomobiles sold today get twice as many miles per gallon as those on the market in 1973. Beginning that year, the economy grew for over a decade without using additional energy.

Today, less developed countries still need enormous GNP growth to achieve a decent quality of life. The average inhabitant of these countries consumes a tenth as much energy as a North American. Though we may consume too much, it would be hypocrisy to deny that they need to consume more, and they constitute three-quarters of the world's population. As they build their infrastructures, their energy use will probably increase *faster* than GNP (as in the United States before the 1920s) because they will need materials ranging from concrete to chemical fertilizers that require a lot of energy to manufacture.

Improving technology is the only way to produce the necessary energy and be sure of preserving the environment. One promising approach, for example, is geothermal energy derived from forcing water through underground rock formations that are two to three times the boiling point. A thousand times the annual world energy consumption exists in this form and could be tapped to generate electricity at current market prices, according to estimates by Jefferson W. Tester of MIT's Energy Lab.

However, if the Third World is to adopt environmentally benign technologies, advanced nations will have to help. Consider China's plan to build 100 million refrigerators in the next decade using chlorofluorocarbons (CFCs) for coolant—the same chemicals that deplete stratospheric ozone, thus increasing skin cancer, and that are the second most important greenhouse gas. By using CFCs, which are cheaper than more benign alternatives, China can make more of the refrigerators it sorely needs. The developing nations will adopt destructive practices of the past unless advanced countries subsidize the cost of doing better. ■

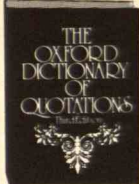
JONATHAN SCHLEFER

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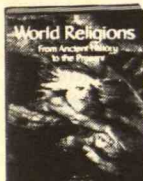
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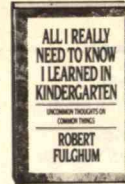


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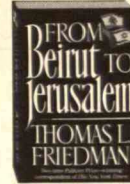
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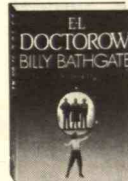
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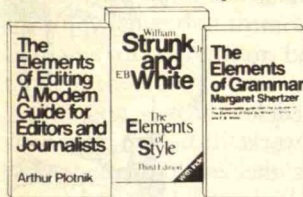
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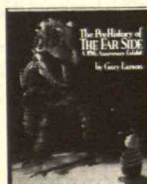
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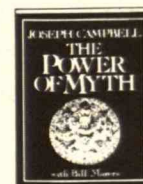
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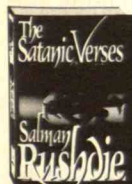
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THE HOUSING MESS

I enjoyed "Renovation and the Housing Crisis" by Jonathan Schlefer (*TR* October 1989). It hit home for me as someone who lives in Los Angeles, one of the most expensive real estate areas in the country.

The legal situation out here, thanks to having almost 100 separate municipalities in the metropolitan area, is a mess. When a local paper asked prominent people what should be done to improve the quality of life in the city, an architect said he wanted to see the building code abolished one rule at a time so that people could build sensible things or renovate existing ones.

On one hand, we have historical preservation groups who want to restore old buildings with public funds; on the other, we have zoning and building regulations that make it far cheaper to destroy structures than to renovate them. You can also sell the unused air space above your property to others, who can then "move" it over to their property and build into it. Of course, there are fees to be paid for this to the city.

Perhaps the ultimate madness is the "art police," a small committee of officials who can stop construction if they do not like the mandatory public artwork to be placed in a building. This is not a matter of refusing to fund, as in the National Endowment for the Arts controversy. Rather, it is absolute control based on the personal taste of political appointees.

Then there's the case of Santa Monica, where a tight rent-control policy implemented by a 1960s leftist city council has converted the population over to yuppies and excluded the poor people it was supposed to help. Low-cost housing attracted renters and at the same time discouraged anyone from entering the market with new rental housing. Therefore, landlords could pick their tenants. The population became DINKs (dual incomes, no kids) with large disposable incomes to spend at fancy restaurants and specialty stores. But the tax base has now shifted to commercial property, and that will be erod-

ed. We could eventually see another South Bronx—empty gutted buildings along with a housing shortage.

JOE CELKO
Los Angeles, Calif.

THE POTENTIAL OF MAPS

David Baltimore makes some valuable points about the Human Genome Initiative in "Mapping the Genetic Wilderness" (*TR* November/December 1989). However, he underestimates the project. The researchers aim to provide the blueprint for homo sapiens—and to do it on an accelerated schedule so that their work can serve as the basis for the biology and medicine of the future.

Geographic maps led to the continental-drift hypothesis. The periodic table, a kind of map of the elements, had an enormous impact on chemistry. The genetic map of humans (and other species) will undoubtedly lead to insights of comparable magnitude.

ROBERT L. SINSHEIMER
Santa Barbara, Calif.

Robert L. Sinsheimer is a professor of biology at the University of California, Santa Barbara.

JOINT CUSTODY OF THE ARCTIC

I lived in Alaska for over 40 years, and my company's business interests are closely tied to development in the Arctic, so I found "Global Commons" by Oran Young (*TR* February/March 1990) particularly interesting.

While the Soviets' statement that the Arctic should be a demilitarized "zone of peace" tends to make experienced people like me suspect ulterior motives, there are in fact concrete indications that the USSR is pursuing more joint natural-resource development in the area, especially within their own sector.



However, in my opinion, the ultimate economic and environmental viability of these ventures will depend on the strength of the internal Soviet economy.

BOB STRONG
Seattle, Wash.

THAT OLD-TIME MATHEMATICS

The proposal set forth in "Making Math Education Effective" by Kenneth M. Hoffman and Lynn Arthur Steen (*November/December 1990*) is of interest in a theoretical sense, but for the most part seems to have little nexus with the real world. For example, in my 81 years I have never had occasion to use the knowledge that three spheres have the same total volume as two cylinders tangent thereto.

I suggest that for most present-day students the ability to solve old-fashioned problems involving percentages, basic algebra, and so on is far more likely to be useful than an understanding of fractals and doubling exponents. Also, the fact that calculators are "making some parts of arithmetic less essential" would provide little comfort to youngsters who simply lack the know-how to confront those old-fashioned problems.

GORDON LISTER
Green Valley, Ariz.

The ideas in "Making Math Education Better" are exciting, but I doubt that they will have the impact their originators hope for. The reason is a fact of educational life: it does not matter how good mathematics curricula or mathematics teachers are if the students don't want to study.

Lack of motivation can be traced to powerful social forces, particularly the mass media, which affect not only the student but also the peer group, the parents, and the community. Entertainers, athletes, doctors, and lawyers are glorified in the media, but there are no messages telling students that a knowledge of mathematics is interesting, will help them understand the world, and can lead to a well-paid job.

It would be difficult to get mathematics integrated to any extent into the

editorial and program content of the mass media. But we could mount a broad and sustained advertising campaign. A recent headline in the News and Comment section of *Science* read "More Math Means More Money"; a campaign with that as a refrain might really work. I realize that many mathematicians will consider such a suggestion crass, but we are in a war for student interest.

E.G. SHERBURNE, JR.
Washington, D.C.

LICENSES FOR ENGINEERS

In "License to Skill" (*TR January 1990*) Samuel Florman advocates mandatory licensing for engineers, but almost everything he writes about, aside from his pride in his profession, supports the opposite conclusion. For instance, he states in his final paragraph that "no test can establish competence as well as a degree from an accredited engineering school" and that "a fondness for credentials and ceremony can lead to shallow bombast." In fact, the shallow bombast already exists, thanks to the National Society of Professional Engineers and others who want to impose licensing. When schools, students, and practicing engineers resist licensing to the degree that they do, we should ask ourselves why.



The first fundamental error of licensing advocates is usually to compare the engineering profession with the legal and medical professions. This probably has its roots in a desire for social status at cocktail parties. However, licensing cannot convey such status as long as en-

gineers are simply salaried employees carrying out tasks little understood by others. That's just a fact of life. Moreover, we engineers do not have the same need for licensing as doctors and lawyers, who for the most part serve people unable to assess their competence. Most engineers work in large corporations in cooperation with—or under the supervision and management of—other engineers.

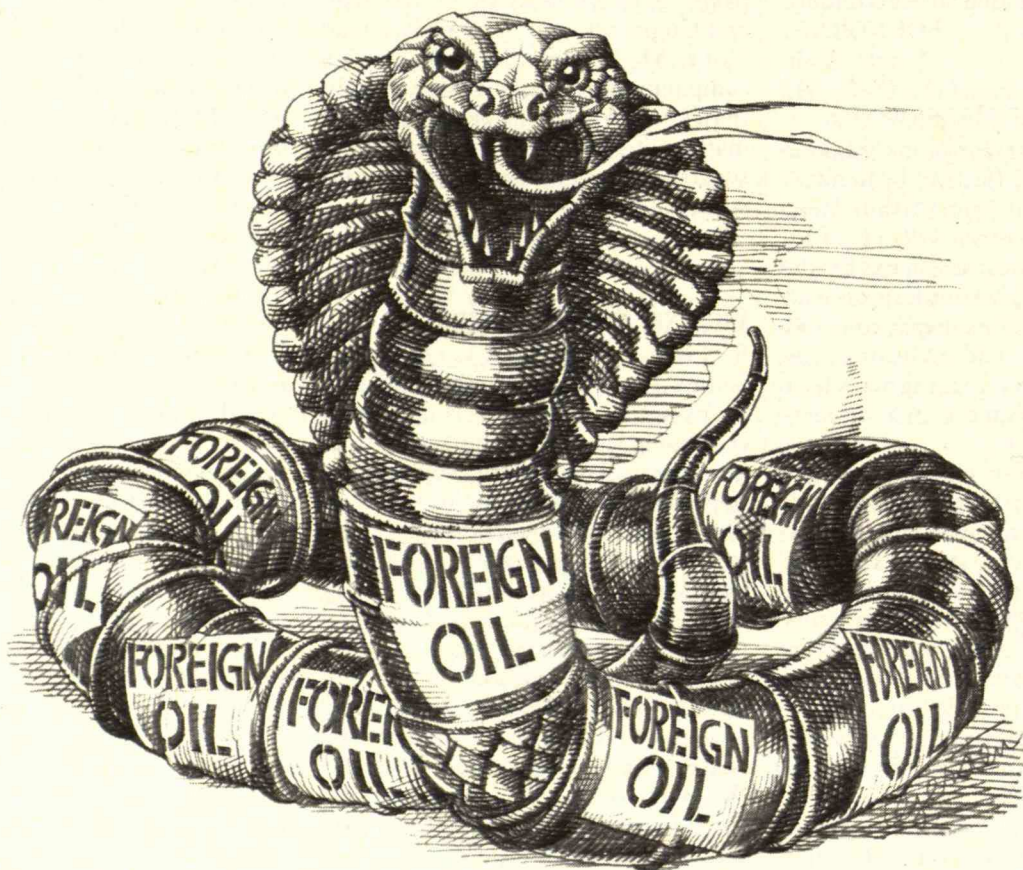
So even if a license isn't really necessary, what harm does it do? Why not, for instance, accept the proposition of the engineering power structure, which is that engineering professors who teach design must hold a license? Why not accept the proposition that after graduating from an accredited engineering program and passing a comprehensive examination, one is only an apprentice engineer or an engineer in training? The reason is simply that we should not be adding to the disproportionate power of a segment of the profession that generally represents the trailing edge rather than the leading edge.

JOEL FOX
Honolulu, Hawaii

I read "License to Skill" expecting to find good arguments to support licensing, arguments I cannot think of myself. However, the reasoning of Mr. Florman is as shallow and old-fashioned as any I have heard before.

I consider licensing degrading. Under one kind of licensing system, people could be "engineers" even if they have spent the past 20 years in marketing—all they would have to do would be to keep up with their licensing fees. Under another kind of system, people with 20 years of active engineering practice, with publications and accomplishments in a specialty field, could have to subject themselves to an examination to prove that they remember Engineering 101. I also find it objectionable that after graduating from a reputable engineering school, one might have to go through a two-day procedure conducted by a bureaucratic government agency. In most other countries, your

Continued on page 79



THE KISS OF DEATH?

We now import more than 40 percent of all the oil we use, and that percentage continues to grow. This excessive dependence on foreign oil could poison America's economy and our national security if our supply were ever disrupted.

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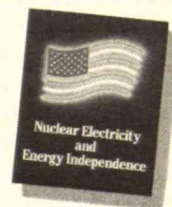
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MIT Reporter

CONTEMPLATING MURDER

 If you believe the media reports, problems like crack, gangs, and automatic weapons are dragging American cities into a deepening bloodbath. But according to Arnold I. Barnett, professor of operations research at MIT's Sloan School of Management, murder rates in the United States are both harder to account for and more stable than they seem on the 11 o'clock news. Barnett brings the same statistical methods to bear on homicide rates as he does on aviation safety and the predictability of criminal behavior. His conclusion: the average city dweller's risk of being murdered is virtually the same today—1 in 68—as it was 20 years ago.

When Barnett first calculated lifetime murder risks—in a 1972 paper coauthored with MIT professors Daniel Kleitman and Richard Larson—criminologists were surprised the danger was so great. They were not accustomed to multiplying annual murder rates by three score years and ten. "Assuming a lifetime is 70 years," says Barnett, "you've got to go into the lottery 70 times and win every time to die peacefully." So in Brooklyn, a borough of 2.5 million people with 600 killings annually, an individual's risk of becoming a victim in a given year is only about 1 in 4,200. "But if you live in Brooklyn for 70 years, there'll be something like 42,000 killings—and your chance of being one of those 42,000 is not so low." In fact, it's 1 in 60.

Of course, one's odds of being done in vary widely by city, gender, race, and other factors. For example, your danger wanes with age—"the more lotteries you pass through successfully." By age 25, the average risk is about 1 in 96; by age 40, 1 in 190; by age 60, 1 in 620.

What most intrigues Barnett about homicide risks is not the changes that occur on a small scale, but the *absence* of change for the past two decades at the national level. "Whether you're talking about the large cities or the nation as a



whole," he says, "things have basically been flat." The number of killings diminished between the 1930s and the 1960s—partly, says Barnett, because of better medical care. "Things that would have been homicides in 1935 became aggravated assaults in 1960." But the murder rate doubled during the 1960s and has remained at that level ever since.

Barnett finds this phenomenon somewhat baffling. At first he assumed that the large number of killings in the late 1960s and early 1970s was an aberration stemming from an unusual climate of violence. "It was a time of great disension over the war in Vietnam. There had been several summers of urban riots. There had been several political assassinations. And the postwar baby-boom kids were coming into the age range where the propensity to commit homicide seems to be the greatest." Yet as the mood of upheaval subsided, the killings did not.

Today, Barnett resists the notion that drugs are causing an upsurge in slayings nationwide. At the end of 1989, the Associated Press reported that "this was

Despite conspicuous violence now, the average city resident was as likely to be murdered 20 years ago.

the bloodiest year on record in at least a half-dozen of America's big cities, and law enforcement officials are virtually unanimous in blaming drug wars for [the] increase in homicide." The list of seven cities included not only the likes of Washington and Philadelphia but also New Haven, Conn., which ranks 136th in size. If the class of cities being considered has 136 members, says Barnett, "then seven of them might have had a record year by chance alone."

He also points out that many cities have retreated from records they set years earlier. Boston, for example, had 100 murders in 1989. "That's nowhere near the high of 135 that was reached about 15 years ago." He adds that in Los Angeles, a city notorious for drugs and gang violence, the number of killings fell by 12 percent—about 100 murders—from 1987 to 1988, and was about 20 percent higher in 1980 than in

1989. Such declines get downplayed in news reports like the AP article on record-breaking violence. "If one wants an overall assessment of what the drug problem is doing to homicides," says Barnett, "one should consider the drop in LA as well as the increase in Washington."

Barnett sees no obvious explanation for why the average murder rate has held steady in the face of new phenomena like crack. Several factors might be responsible, he says. For example, the recent migrations to U.S. cities by Asians and suburban professionals—groups known for low rates of violence—may have had a counterbalancing effect. "Another possibility," he says, "is that some of the crack killings that go on now would have been heroin killings 15 years ago. In fact, because crack is a lot cheaper than heroin,

that may reduce some of the crimes just to get the money to support the habit."

But in the end, Barnett is tempted to throw up his hands. If factors like gentrification, the return of capital punishment, crack, and the rise of automatic weapons have no aggregate effect on murder statistics, he says, perhaps it's because their individual effects are small. "It's as if there's some evil machine out there that generates homicides at a certain rate per year and is impervious to what's going on in the world. Somehow the process seems to have a life or death of its own."—DAVID BRITTAN is an associate editor of Technology Review. ■

FEELING DOWN? TRY EATING

Many women who suffer from premenstrual depression find that they load up on carbohydrates when their periods are imminent. Women's magazines therefore sometimes carry articles advising overweight women to avoid pastry, candy, and cookies then. But a study conducted at MIT's Clinical Research Center suggests that carbohydrates can actually make many premenstrual syndrome (PMS) sufferers feel better.

Foods high in carbohydrates substantially decrease depression, tension, anger, and other symptoms of PMS, a team of scientists points out in a recent article in the *American Journal of Obstetrics and Gynecology*. The explanation probably relates to the fact that the chemical serotonin, which is involved in mood change, increases in the brain after people eat carbohydrates, say Judith J. and Richard J. Wurtman of MIT's Department of Brain and Cognitive

Science, Amnon Brezezinski of Jerusalem's Hadassah Medical Center, and Blandine Laferrere of the Hotel Dieu in Paris. These researchers postulate that a craving for carbohydrates may be the body's way to improve mood.

Women who are trying to keep off extra pounds should realize that "the carbohydrate does not have to be heavily caloric," Judith Wurtman says. "One can substitute plain baked potatoes for potato chips." ■

TRADING PLACES

Research strategies at Japanese and U.S. manufacturing companies are looking more like each other these days.

U.S. firms have learned to spend a larger percentage of their R&D dollars on applied development, while the Japanese have recognized the value of putting yen into basic research, according to D. Eleanor Westney, MIT associate professor in international management. And American R&D managers increasingly stress teamwork, while their Japanese counterparts are working hard to foster individual creativity. This is the case, for example, in the auto industry.

Although these changes indicate a meeting of minds, many engineers in both countries still find it hard to alter their working cultures much. After idealizing Nipponese manufacturing approaches, Americans who become aware of the complex realities in Japan—such as the long work hours—often resist altering their work habits. For their part, many older Japanese engineers equate the American individualistic approach with self-indulgence and laziness, Westney said at a recent conference on engineering careers. ■

TechnologyReview

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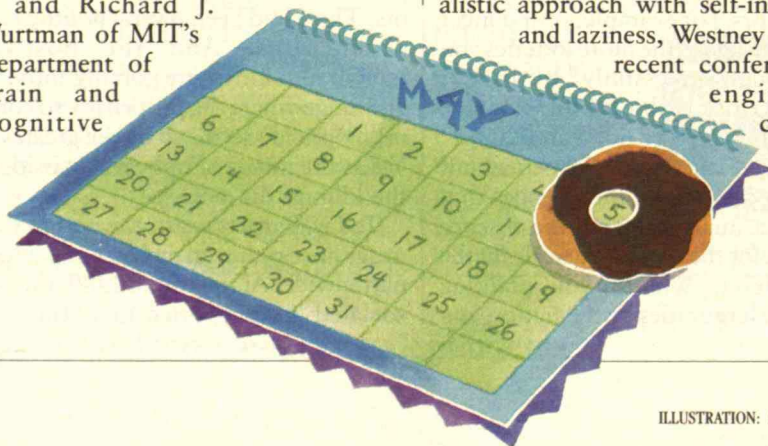
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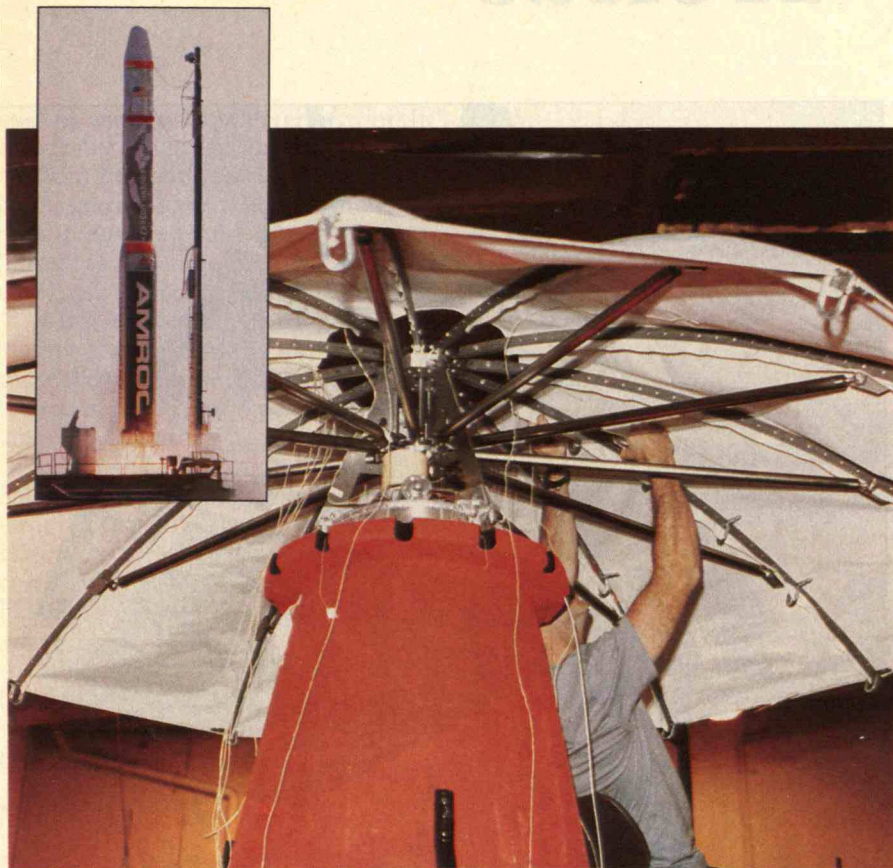
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HAVE UMBRELLA, WILL TRAVEL

 Could the astronaut of the future descend to earth with an open umbrella?

The umbrella, which would open at the lower end of a spacecraft during reentry, would function as a heat shield, in a design developed by Richard Patten, who graduated from MIT last year, and Institute graduate students Judson C. Hedgecock and Russell D. Howard. The three Department of Aeronautics and Astronautics designers came up with the idea because of NASA's problems with the space shuttle's heat-absorbing tiles. NASA has replaced some tiles—many of which fall off on every trip—with a thermal blanket material. Since this material cannot withstand as high a temperature as the tiles, the agency has not used it exclusively.

Yet Patten, Hedgecock, and Howard have developed their umbrella out of the thermal blanket material alone. To deal

Russell D. Howard assembles the heat shield he and other MIT students designed for a space capsule. Inset: Last October, they unsuccessfully tried to test the capsule.

with the heat problem, they have redesigned the manned capsule used before the shuttle so that it is more cylindrical in shape. Because the surface area is increased, more heat dissipates during reentry, Howard explains.

The design would cushion delicate payloads, Howard believes, because the craft would decelerate more slowly. This might help prevent damage to crystals manufactured in space. He thinks the craft is an alternative to but not a substitute for the shuttle.

The design has yet to be tested. The American Rocket Co. attempted a suborbital test this past October with a craft 30 inches high and 30 inches across and an umbrella heat shield made of fiberglass-embedded Teflon. That try failed, however, when the booster rocket fell over and burned for reasons unrelated to the craft design. ■

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Trends

Better Homes for Less

Pre-fab and modular housing, once marketed mainly to resort and suburban developers, may be a ray of hope for many Americans priced out of homeownership in the 1980s. In pre-fab housing, factories manufacture and pre-assemble components—walls, stairs, floors, and ceiling panels—that are later joined together at construction sites. In modular housing, complete sections of a home arrive in the field.

Although pre-fab and modular techniques have been applied to low- and moderate-income developments around the country in recent years, no one expects them to yield a housing boom. After a decade of declining federal housing subsidies, even advocates don't claim such technology will solve the nation's housing needs.

At a site in Baltimore, Md., employees of the pioneering Rehab Work Group recently joined pre-built upper and lower sections of town houses in a project that will provide shelter for 171 low-income families. The units, shipped from Ryland Modular Homes in Northeast, Md., came complete with all interior trim details, including cabinets, smoke detectors, and bathroom and light fixtures.

The Rehab Work Group is a division of the Enterprise Foundation established by James Rouse, the developer who is famous for upscale downtown projects in Baltimore, New York, and Boston. The foundation has financed some 16,000 housing units, giving funds to some 100 non-profit community development corporations in 27 cities and towns.

Working with the Greater Miami Neighborhoods, the foundation helped finance 11 low-income single-family houses in Opa Locka, Fla. That project introduced innovative "foam panel" technology: a factory-manufactured exterior wall that combines drywall inside the house, plywood on the outside, and electrical connections in between. Manufactured Building Systems in Opa Locka made the



panels. Each home cost \$32,000 to build, 20 percent less than any other housing produced in the county.

In Boston, when the Public Facilities Department (PFD) makes vacant city lots available for affordable housing, it recommends that developers hold down costs with modular or other pre-fab construction. According to a PFD study, factory construction can knock as much as 20 percent off the cost of conventional building methods in the city's overheated housing market.

Last year, the department sponsored a competition aimed at stimulating local architects and modular fabricators to develop low-cost designs. In Roxbury, winner John Sharatt is building five duplexes. His modular design is based on an identical core block that has several vari-



Top: The Rehab Work Group has assembled pre-fab units for homes at Franklin Terrace in Baltimore. Above: "Foam panels" have helped lower the cost of Opa Locka, Fla., houses.

eties of windows and exterior trim. It also features a garage under each unit that can be converted into additional living space. Sharratt believes that adjacent parking and an individual "look" to each house are critical to a developer's success in the inner city.

Most observers say these mass-production techniques can lower costs because they save time and materials and reduce the need for expensive on-site labor. But Gregory Beck, a senior architect in the PFD, thinks that about half the savings come from lower financing expenses. He cites "the shorter time period for relatively costly, high-risk construction loans." Financing begins after modular units arrive from a factory. In traditional stick-built construction, on the other hand, builders start paying interest with the first shipment of raw materials.

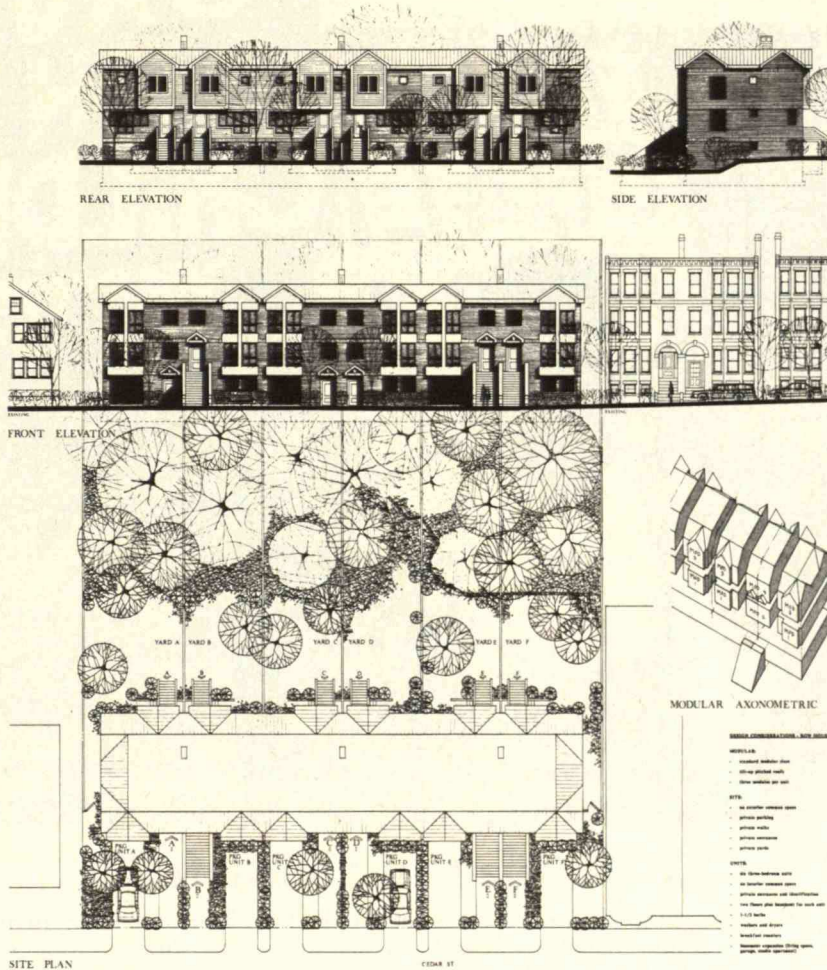
Needed: More Money

No one claims that modular or pre-fab housing is a panacea for homelessness and soaring housing costs. For one thing, Beck notes the difficulty he has attracting modular fabricators to the inner-city market. He says that transportation problems, on-site security, and opposition from construction unions all discourage modular development.

Further, Beck points out that many affordable-housing developers and construction managers have little experience with the peculiarities of modular design. Bob Santucci, a consultant to the Rehab Work Group, says he is frustrated with finding non-profit developers capable of completing modular jobs on time.

Modular designs can also inhibit creativity. According to Sam Rappaport, who trains carpenters at Boston's non-profit Home Building Institute, "Using a modular design may lock you into a design that prevents creative local decisions."

Moreover, rehabing old housing remains much cheaper than building new units using modular or pre-built



techniques. "There is a tremendous value in the older, lower-priced structures in our cities," says Santucci. "Rehabing them is much more economical than building anything new."

Pre-fab and modular housing efforts also share a number of problems with other approaches to building low-cost homes. Santucci says that too often, only unwanted land is available, so low-cost inner-city housing construction tends to be relegated to inferior building sites. That's another reason the Enterprise Foundation continues to focus its efforts on rehabing.

Finally, neither rehabing nor novel technology can address the lack of money available for affordable housing. Rouse, who headed a National Housing Task Force in 1988, has told Congress that making significant in-

In Boston, John Sharratt's design has won an award by stretching the "creative use of a module to the limit."

roads into the shortage of affordable housing requires boosting federal subsidies. Yet such funds fell from almost \$33 billion in 1980 to about \$8 billion this year.

"The only way to build low-income housing is to put subsidies into it," says Helen Szablya, the Enterprise Foundation's public-relations director. Adds Santucci, "I don't think that it's a technological problem. It's a land and capital costs problem." ■

RAND WILSON and **MARK SOMMER** are free-lance writers in Boston, Mass. Wilson is a member of the United Brotherhood of Carpenters.



RU 486: More Than an Abortion Pill

■ Anti-abortion sentiment dims the possibility that RU 486 will soon reach U.S. women, but that hasn't stopped research into other uses for the French "abortion drug." The result may be a viable birth-control method, a way to ease difficult births, and a treatment for some hormonal diseases.

Taken under the proper conditions, a large dose of RU 486 interrupts the preparations in a woman's womb for the growth of a fetus, leading to a spontaneous abortion 96 percent of the time. In France, the only nation that has approved the drug, 40,000 women used it in 1989 instead of standard abortion methods.

Etienne-Emile Baulieu, who developed RU 486 for the French company Roussel-Uclaf, has always envisioned that it would be used for birth control. RU 486 blocks production of the female hormone progesterone, and de-

pending on when and how often a woman takes RU 486, it can theoretically halt an egg's release, much as current oral contraceptives do. It may also keep fertilized eggs from implanting in the uterine wall. Or the woman may simply experience normal menstrual bleeding, which sheds the uterine lining even if a fertilized egg has already been implanted.

Lynette Nieman of the National Institutes of Health has looked at RU 486's contraceptive effects. In one study, ovulation was delayed for women who took small doses for several days during the first half of their menstrual cycle. In a study using larger doses, Nieman induced menstruation by giving women RU 486 in the second half of their menstrual cycle. (Because of a ban on federally funded abortion research, she studies women who have little chance of becoming pregnant.)

This work, later extended by Finnish researchers who completely suppressed ovulation with larger doses, suggests that women may eventually take RU 486 as an estrogen-free contraceptive. That would provide an alternative for women over 35, for whom the current hormone-based contraceptives increase the risk of cancer.

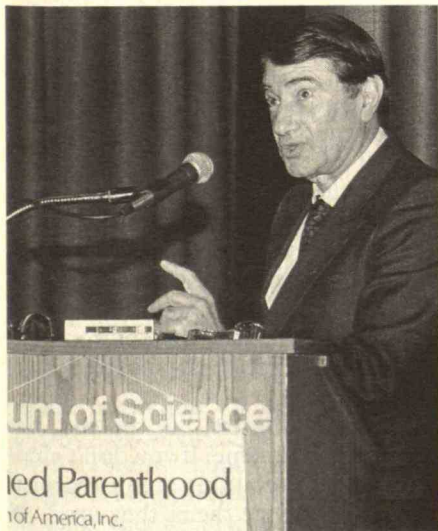
Unfortunately, RU 486 might also result in lower estrogen levels, which has been linked to osteoporosis. And other problems have surfaced as well. One side effect of inducing menses with RU 486 is a shorter menstrual cycle, and the consequences of such a disruption are unknown. Nor are the long-term effects of repeated doses known. Finally, some uses of RU 486 may not be effective enough for routine birth control. If fertilization has already occurred, it induces menses only 80 percent of the time.

A Caesarian Alternative?

As a medication, RU 486 may join a body of existing hormonal therapies for breast cancer, which the female hormones estrogen and progesterone appear to promote. In one common breast-cancer treatment, women take Tamoxifen, which blocks estrogen receptors and sometimes slows or reverses the growth of tumors. Experiments conducted in Europe suggest that RU 486 could have a similar effect.

Tested on small groups of long-term breast cancer patients, whose previous treatment had included large amounts of antiestrogens, RU 486 halted the spread of some tumors and shrank others to less than half their former size. Repeated hormone therapy usually loses its power, so this success is intriguing, notes Georgetown University cancer specialist Susan Flamm.

According to Flamm, about 18 percent of the patients in these European trials suffered side effects—mild nausea, hot flashes, and dizziness. Some subjects also developed slight potassium deficiencies, but, says Flamm,



When Etienne-Emile Baulieu invented the abortion pill RU 486, he envisioned that it might also serve as a birth control device.

these presented no clinical problems.

RU 486 might reduce the need for Caesarian sections as well. According to Roussel-Uclaf medical director André Ulmann, "Our animal tests have shown that RU 486 may be useful in triggering normal-term delivery." The progesterone block not only softens and dilates the cervix and induces uterine contractions, it also stimulates milk production. If the results hold up in humans, obstetricians could set aside the complex mixture of drugs they use in difficult births, none of which trigger lactation.

Nevertheless, the abortion debate is sure to slow the entry of RU 486 into the United States. Roussel-Uclaf has only tentative plans to distribute the drug for abortions here, and no immediate plans to market it anywhere for uses other than non-surgical abortion.

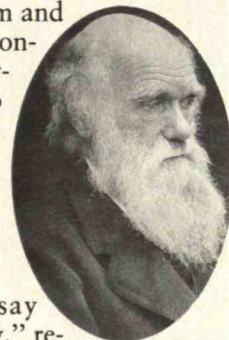
Roussel-Uclaf's reluctance to approach the U.S. market—perhaps 400,000 doses a year—is matched by the lack of interest major U.S. drug companies show in licensing the product. "We haven't received any inquiries from the large firms," says Catherine Euvrard, Roussel-Uclaf's communications director. A handful of smaller firms and public-interest groups have approached Roussel-Uclaf, but they have received only rejections or noncommittal responses. That hesitation reflects the fear that consumers may boycott other products of A.G. Hoechst, Roussel-Uclaf's parent company, Euvrard admits.

Still, U.S. distribution might come eventually, and Roussel-Uclaf is promoting RU 486 more aggressively these days. In February, Baulieu told a Planned Parenthood symposium in the United States that the firm plans to seek formal approval to sell the drug in Great Britain, Scandinavia, and the Netherlands. And he predicted that success in Europe would ease U.S. approval. ■

DAVID P. HAMILTON is a reporter-researcher for The New Republic.

Rethinking Darwin

Several biologists studying mutations in bacteria are challenging a key assumption of Darwin's theory of evolution. While these scientists have no intention of throwing out Darwinism and advocating creationism, several experiments over two years indicate that a hostile environment may actually spark some bacteria to adapt.

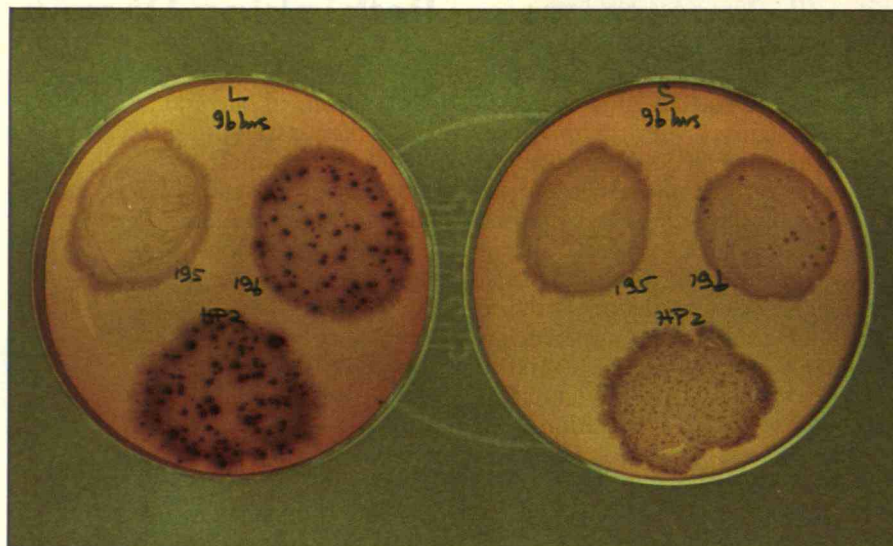


"Darwinists say this is rank heresy," remarks Harvard University cancer biologist John Cairns, one of the leading challengers. Darwin's theory holds that mutation and selection are related but independent. Mutations arise continuously, he adds, "by whatever cell mechanisms produce them, essentially at random," and the environment simply "selects" or winnows out fit variations from unfit ones. "These two processes are just absolutely independent—that's dogma," says University of Rochester biologist Barry Hall, another rebel.

Darwinists have long pointed to experiments from the late 1940s and early 1950s as evidence for natural selection. Exposed to harsh conditions, bacteria with the right mutations survived and multiplied. These mutations—and a variety of others—dotted earlier generations of the bacteria, and natural selection appeared to pick the ones that would aid survival.

However, argues Cairns, those earlier experiments were designed to "kill anything that couldn't pass the test." As a result, he says, they eliminated any way to examine the possibility that organisms may mutate in response to an environmental hurdle.

Searching for such a hurdle, Cairns and two Harvard colleagues recast the 40-year-old experiments. "We used a



Left: John Cairns has conducted experiments that show how three bacteria strains can mutate spontaneously to burn extra sugar in their environment and grow faster than their neighbors. Below: Barry Hall has made a similar challenge to Darwinian dogma.

Why, Not What

As Cairns admits, the affronts to Darwin are all statistical. So were the experiments conducted four decades ago, "but these days, that kind of argument is not considered proof of anything," Cairns says. "People in biology don't feel happy . . . unless you have established the mechanism for the phenomena you're looking at. That is what we're doing now."

His speculations are radical. For example, he guesses that perhaps cells test out a selection of mutations through trial and error, and finally adopt the best one.

Other biologists aren't buying that. "Cairns raises questions about the foundations of molecular biology," according to Harvard's Bernard Davis, a pioneer in bacterial genetics. Cairns would have you believe "that information from the environment can get directly to the DNA and tell it what to do," he says. Even Hall is skeptical. "It's hard to envision the molecular mechanism by which the DNA can communicate with the environment," he observes.

Hall is "looking for alternative explanations that don't require us to invoke a whole set of cellular mechanisms that we don't know to exist." He suspects there may be some "underlying random mechanism" that doesn't require that the environment cause a specific mutation, except indirectly.

"But," Hall adds, "in the end, the outcome is the same: If you don't challenge cells, mutations aren't there; if you do challenge them, they are." ■

TOM KIELY is a staff writer at New England Business and a regular contributor to Technology Review.

test that was not immediately lethal," Cairns says. The researchers worked with bacteria containing a gene that had to mutate for the organism to generate energy by fermenting the sugar in which it was growing. If that gene didn't mutate, the bacteria would have no energy source but would still survive for quite a while.

Over several days, Cairns watched how rapidly the bacteria's genes mutated to take advantage of the sugar, comparing the changes with those that might have occurred if the environment had called for a different response. The results differed significantly from what would have been expected based on the earlier experiments, suggesting that the environment did in fact influence mutation—perhaps even directing it. At the very least, Cairns and his colleagues have cast doubt on conventional Darwinist axioms.

Hall has taken the challenge to Darwin a step farther, using a bacteria that can't thrive in salicin, a sugar derived from the bark of aspen trees. This bacteria can grow on other sugars, but Hall's strains would need to mutate twice before they could grow in salicin. They did just that, even though one of the two mutations occurs so rarely under normal circum-

stances—less than two in one trillion cells—that it is undetectable, according to Hall. In fact, the mutations needed to survive appeared in more than one in one hundred cells—"so common that you couldn't miss them," Hall reports. He concludes that "the evidence is very strong that there are mutations that happen more often when they are useful than when they are neutral."



Satellite Strife

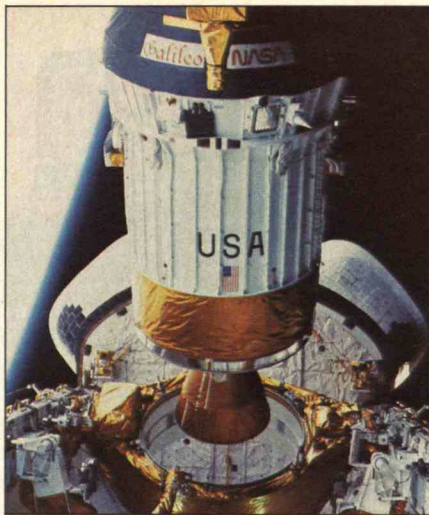
■ Last October's launch of the *Galileo* space probe elicited an unprecedented public outcry. Claiming that the 48 pounds of plutonium on the Jupiter-bound vehicle threatened the environment and public health, critics organized rallies and even went to court to try to stop the mission.

Leading the challenge to such hazards has been the Florida Coalition for Peace and Justice, an umbrella organization of 75 peace groups and church committees. The coalition has claimed that up to 34,000 people could have contracted cancer had the space shuttle carrying *Galileo* exploded at launch, scattering plutonium over the countryside. An explosion would have taken years and cost millions of dollars to clean up.

Though *Galileo* is on its way now, the controversy could seriously affect future U.S. space efforts. The plutonium in question powers a radioisotope thermoelectric generator (RTG). RTGs are not nuclear reactors. Rather, the decaying plutonium in them gives off heat that is converted directly to electricity.

RTGs are well suited to spacecraft traveling to the outer solar system, where sunlight is weak and solar panels less efficient. For example, a spacecraft orbiting Jupiter gets just 4 percent of the light it would receive near earth.

NASA says that RTGs don't pose a significant danger. According to Dudley McConnell, NASA's deputy director for advanced programs, "We have a huge database on their performance and operation and have a well-established technique for analyzing their safety." Between 1961 and 1977, the United States launched almost two dozen RTG-powered spacecraft—including the deep-space *Voyagers* 1 and 2 and *Pioneers* 10 and 11. (None went up between 1977 and the *Galileo*.)



Some environmentalists tried to halt the launch of the space probe Galileo, which contains plutonium. That launch went ahead, but future ones still face legal obstacles.

McConnell describes the design philosophy behind RTGs as "containment." Plutonium fuel pellets are encased in iridium, a metal that deforms instead of cracking or breaking, and two outer shells of graphite epoxy. Tests with high-velocity shrapnel and bullets have shown that this encapsulation will prevent plutonium from being released, McConnell says, even in the worst-case scenario of a booster explosion on the launch pad.

Galileo carries two RTGs, each containing about 24 pounds of plutonium 238, and one will power next fall's *Ulysses* probe. Though *Ulysses* will study the sun, it must spend the first 14 months of its five-year trip traveling outward to Jupiter so that the planet's gravity can slingshot it past the sun's south pole. Hence the decision to use an RTG.

NASA also intends to use RTGs on the *Casini* spacecraft to Saturn, as well as on a probe to study comets and asteroids, both of which are scheduled for the mid-1990s. RTGs could also generate the electricity for NASA's planned Mars and moon landers sometime after 2010.

Worst-Case Planning

Concern about RTGs doesn't end with environmental issues. Bruce Gagnon, coordinator of the Florida coa-

lition, believes "there is a strong connection between the weapons industry and the use of nuclear power in the civilian space program." He says civilian RTGs will create "good feelings" about using nuclear power on military spacecraft, which has been proposed for SDI.

Among the evidence the coalition cites against RTGs is a 1981 study by Donald Rockey and seven other Jet Propulsion Laboratory (JPL) scientists. The report states that "a *Galileo* Jupiter orbiting mission could be performed with a concentrated solar array (CSA) power source."

However, Rockey dismisses the idea that solar power is a near-term alternative for deep-space probes—especially *Galileo*. He explains that the report was a very preliminary look at what might be possible in solar power for future space probes. *Galileo* was selected as a hypothetical example because its well-defined objectives made it a good case study, not because anyone was considering changing the craft's power source. He now estimates that CSA won't be practical for 10 to 20 years.

To further its campaign against RTGs, the coalition has enlisted the aid of the Christic Institute, a Washington-based non-profit legal organization. Last summer, Christic asked NASA to delay *Galileo* until "an environmentally benign alternative to the plutonium can be found," according to Larry Sinkin, the institute's litigation director. He believes that would have meant a delay of five to eight years.

The space agency refused and a Christic lawsuit failed to stop the launch. But the institute has made an early start in its legal fight to prevent the *Ulysses* launch. "If we had had 30 more days," says Sinkin, "we could have stopped *Galileo*." ■

ROBERT NICHOLS is a free-lance writer specializing in space science and technology.

Clean Cars

For a century, petroleum, one of the dirtiest motor fuels, has powered most automobiles. Its fumes contribute more than half the carbon monoxide in the air, a third of the nitrous oxides, a quarter of the hydrocarbons, and nearly a third of the carbon dioxide.

While clean-air laws could aid a switch to other fuels, legislators aren't sure which alternatives to promote, since even experts disagree about the trade-offs involved. Each possibility reduces some pollutants, but sometimes at the price of more serious ones. All the available choices require technical retooling and time for consumer acceptance.

"There is no ideal policy at the present time, no energy panacea," says James Cannon, an energy consultant at INFORM, an environmental research group. Still, for the short term, he favors compressed natural gas. Natural gas costs less and is more environmentally benign than gasoline or methanol. Also, Cannon argues, the United States has large reserves of it.

However, compressed natural gas isn't liquid, so existing filling stations would have to be adapted to handle it. It needs five times as much storage space as gasoline, and cars using it travel only half as far between refueling as those running on petroleum.

Nevertheless, most alternative-fuel vehicles on the road use compressed natural gas. It powers 22 million vehicles in government and corporate fleets, whose owners have their own fueling stations. With reserves close at hand, Texas requires fleets to be fueled with compressed natural gas. In a pilot program, Canada has put some 8,000 privately owned compressed-natural-gas cars on the road.

In the United States, however, methanol, an alcohol that can be made from coal, wood, natural gas, or other materials, is emerging as the

main rival to gasoline for private cars. Since it's liquid, today's cars could adapt to it with only minor technical changes.

Methanol is the clear favorite of carmakers, who believe consumers would accept it readily and enjoy its zip. A cleaner fuel than oil, methanol yields more horsepower and acceleration—it's popular in race cars. It produces no particulate emissions, and carbon-dioxide emissions are at least

7 percent lower than gasoline's. Prototype methanol engines can eliminate 95 percent of some hydrocarbons; real world engines achieve roughly 30 percent.

Methanol has many drawbacks, though. Cars powered by it are sometimes hard to start when the temperature falls below 50°F. Mechanics are leery of its toxicity: it burns the skin and peels paint. Siphoning is hazardous—swallowing an ounce can

blind or kill a person. And the fuel's hard-to-detect transparent flame is a danger.

Moreover, methanol is environmentally suspect. It doesn't lower carbon-monoxide or nitrogen-oxide emissions much, and compared with gasoline, it releases much more formaldehyde, a potent carcinogen and contributor to smog. Also, if made from coal, methanol can double carbon-dioxide emissions.



Finding the Proper Mix

M85—85 percent methanol and 15 percent gasoline—overcomes a few of these problems. M85 cars start at cold temperatures, and the blend burns with gasoline's yellow tint. California has ordered 5,000 M85 vehicles.

Apart from technical points, M85 has become the Bush administration's fuel of choice because it wouldn't cut into gasoline sales, says Roger Goodman, a staffer for Rep. Robert Wise (D-W.Va.). He notes that M85's clean-air benefits match those of the improved gasolines that have appeared since last July, when President Bush called for 500,000 alternative-fuel vehicles by 1997.

These alternative fuels developed by oil companies usually substitute benzene and other aromatics for lead as an octane-booster. But benzene, which is unregulated, may not do much for the air. A California study

has judged benzene in car exhaust to be the single worst air-toxics problem.

In late 1989, ARCO released EC-1, a blend that doesn't use aromatics. However, EC-1, marketed first in Southern California, may be too expensive to produce nationally, and it probably wouldn't significantly reduce the contribution automobiles make to global warming. In the opinion of White House counsel C. Boyden Gray, "Ultimately, it may be cheaper to convert fuel systems [to non-gasoline fuels] than to take out the aromatics."

As for carmakers, methanol's lower cost attracts them, but their new flexi-vehicles—which sense fuel content and adjust to it—let drivers use a variety of fuels. In the future, such cars might accommodate ethanol as well. Another alcohol, ethanol is made from corn or sugar cane. Like methanol, it's liquid but less toxic and more powerful.

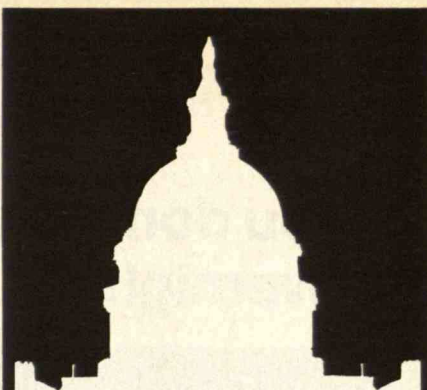
One problem with ethanol is that it costs twice as much as gasoline. But Migdon Segal, a Congressional Research Service specialist in science and technology, notes that economic incentives could boost its use. Moreover, if ethanol were made from solid waste rather than corn, says David Lindahl, director of the Department of Energy's Alcohol Fuels Program, "you could stand economics on its ear." He reports that pilot programs show great promise in creating ethanol from "paper, plastic—virtually everything in a landfill."

In any case, it may be dangerous to rely on any of the current alternatives beyond the near term. "It's all transition," cautions James MacKenzie, an energy researcher at the World Resources Institute. "We will have to move toward emission-less cars down the road, so let's be prepared to change gears in 15 years." ■

FRANCESCA LYMAN has covered environmental issues for 10 years. She wrote *The Greenhouse Trap* (Beacon Press, 1990) for World Resources Institute.



Gasoline has powered cars for almost a century, but today environmental concerns have stimulated interest in alternative fuels. Methanol, made from coal, wood, or other materials, has the zip needed for racing cars in the Indianapolis 500. Yet it, too, creates pollution.



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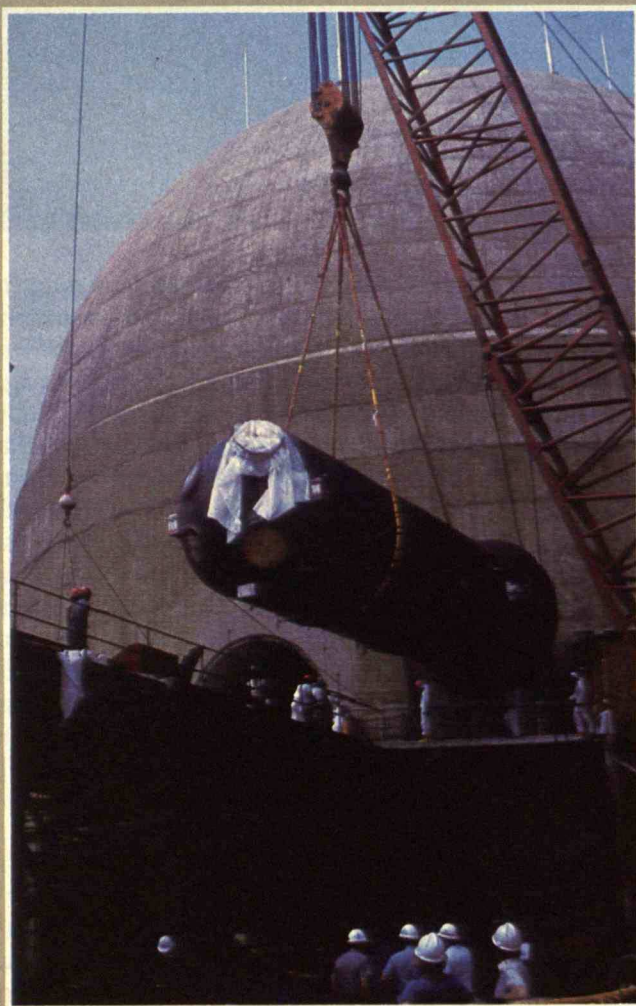


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By MICHAEL W. GOLAY

Longer Life for Nuclear Plants

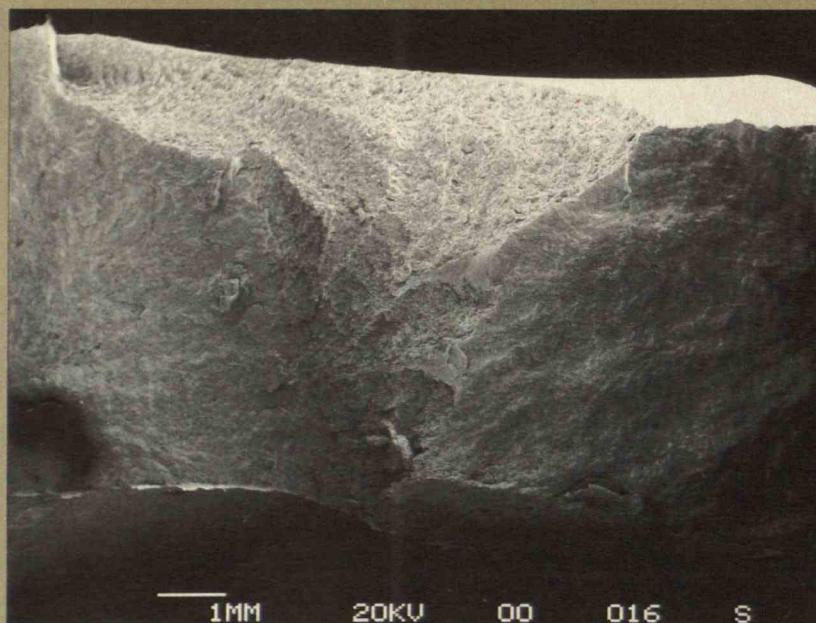


A power plant receives a new steam generator—a measure that may be necessary to prolong the lives of some pressurized-water reactors.

MANY of America's nuclear power plants will soon be nearing the end of the 40-year life span allowed by a Nuclear Regulatory Commission (NRC) Operating License. At the Yankee plant in Massachusetts in the year 2000 and at 11 other plants later in the decade, utilities may have to start the multibillion-dollar process of taking apart facilities that took years to build. If recent trends in power consumption continue, this lost generating capacity will need to be replaced. Yet because of safety and environmental controversies, building new plants—coal as well as nuclear—has become exceedingly difficult.

Utilities, regulators, and researchers are exploring a way out of this bind: plant-life extension, or PLEX. Studies sponsored by the Electric Power Research Institute (EPRI) in conjunction with the U.S. Department of Energy (DOE) and Electricité de France (EDF) have estimated that today's nuclear power plants could operate for as long as 70 years. For that to happen, certain conditions will have to be met. First, the utility

As U.S. reactors approach the end of their official life span, researchers are exploring ways to keep them running for decades longer.



must undertake vigorous monitoring and maintenance programs to keep the plant in good condition and to minimize component wear. Second, replacing major components such as steam generators must be technically feasible. In most cases, this has proved possible, but difficult and expensive. Third and most important, the studies conclude, any life-extension program should begin early and focus on the entire plant.

Studies at Minnesota's Monticello plant, Virginia's Surrey plant, and elsewhere have shown the benefits. For example, the net economic value of an additional decade of operation is in the range of \$1.0 billion to \$2.8 billion per 1,000-megawatt plant. A longer life span would encourage utilities to invest heavily in maintenance and improvements instead of treating plants as decaying assets. With such upgrades, reactors would be available to produce electricity more of the time. In fact, plant-life extension could be self-financing: some extra monitoring and maintenance steps would both raise a plant's availability and lower the need to replace or refurbish components, thereby paying for themselves many times over. These steps, combined with the more detailed record keeping that would be necessary for PLEX, could also make plants safer and better understood.

By improving safety and economic performance, PLEX could lead to better relations between plant owners and regulators. At the same time, it might increase public support for new nuclear power stations as concern grows about oil imports and possible global warming from fossil-fuel use.

For now, though, the future of plant-life extension

MICHAEL W. GOLAY is professor of nuclear engineering at MIT. He leads the Institute's program in advanced nuclear power studies, which seeks to ensure a successful next generation of nuclear power plants.


remains cloudy. The industry has not yet determined the best maintenance program to keep reactors running smoothly for an extra 20 or 30 years. Researchers are still learning about the effects of plant aging and how best to combat them.

Perhaps more uncertain still is the regulatory climate. In October 1989, the NRC issued preliminary guidelines for extending a plant's Operating License. But many plant owners, wary of the agency's unpredictable behavior in regulating reactors, are pursuing PLEX at less than full steam. They are waiting to see how the NRC handles the Yankee plant's pioneering application for an extended license in 1991—and whether the agency will be reasonable and timely in issuing definitive guidelines. Only if the outcomes are favorable are plant owners likely to invest enough in their reactors to make PLEX work.

Combating the Effects of Age

To keep a nuclear plant running efficiently over an extended period, the utility in charge must constantly anticipate which components are likely to fail and when. It must then put this knowledge to work in either of two ways. First, for components that are not important for safety, the utility can be prepared to remedy any failures quickly—for example, by storing replacement parts on site. Second, it can try to prevent failure. This means modifying the operation of the plant (say, by reducing power or decreasing the temperature of corrosion-prone components) or making maintenance more extensive and more frequent.

Either strategy can be difficult. Manufacturers may stop making a needed component, forcing plant operators to find a substitute. (This is a particular problem



"Stress corrosion cracking" is one of many aging effects that plague nuclear reactors. Magnified samples from the steel shell of a steam generator show areas where the harsh environment has caused cracks. The third sample, magnified 1,000 times, has been chemically etched to make features clearer. The dark streak is a tiny fracture, part of a two- by three-inch crack that penetrated the generator shell, causing a leak. Possible solutions: adjusting the water chemistry, using more resistant material, or heating the shell to eliminate residual stresses.

with electronic components.) And even if new parts are available, several components in nuclear power stations are difficult and expensive to replace. For example, the reactor vessel is large, heavy, and deeply embedded within the plant. Portions of the containment building, such as the steel walls holding the pools that quench steam from the reactor coolant system, may corrode and can be difficult to reach. To repair water storage tanks and heat exchangers deep within the plant, the building may have to be substantially dismantled. The same is true for repairing pipes and cables that pervade the facility.

Thus, utilities must try to avoid having to replace such components. For example, reactor manufacturers are exploring whether it is possible to anneal the reactor vessel in place—that is, to heat it to above 850° F for about a week to relieve stresses that accumulate in the metal as it is bombarded by neutrons from the reactor. If this could be done, it might be possible to extend the life of nuclear plants even beyond the posited 70 years.

The strategy of preventing failure is also hard to carry out comprehensively. Ideally, utilities would like to be able to project the availability and safety of the plant over time. Doing this would require performance models that identify the most vulnerable components, when they might become susceptible to failure, the rate at which they would degrade the plant's operations, and the costs of mitigating any problems. Such models would also estimate the changing limits for safely operating each component, as when corrosion thins the walls of hydraulic components.

Before utilities can develop adequately reliable models, however, more research needs to be done on the effects of aging on various components. One of the

biggest age-related problems is metallic corrosion. This effect has already forced utilities to replace 25 steam generators at U.S. plants and to install new recirculating water piping at 23 plants worldwide. Corrosion also affects components such as steam extraction pipes, water pumps, reactor fuel cladding, condenser tubes, and instrument tubes that penetrate components. Another aging mechanism is wear, which causes failures in control rod drives, pump bearings, and other moving parts. And components such as electrical insulation, hydrocarbon-based seals, and the all-important reactor vessel can become brittle after years of exposure to heat and radiation.

Such mechanisms are the subject of research sponsored by the NRC and conducted mainly at the national laboratories. The goal of most of this work is to determine safe limits for a component's service life. One way researchers are doing this is by examining plants' operating histories to determine the rates at which components have failed in the past. Another approach is to accelerate the aging of plant components and observe how well they function. For example, researchers are bombarding components with neutrons at higher than normal rates, and speeding up the oxidation of organic materials by exposing them to higher temperatures and richer concentrations of oxygen.

Although data from the NRC program will ultimately help plant operators to anticipate failure patterns, knowledge of the multitude of mechanisms that degrade reactor materials will always be incomplete. And even with accurate models, there would be no guarantee that a particular plant is aging on schedule. Because of these uncertainties, PLEX programs will have to rely heavily on monitoring the actual condition of sensitive components.

Many reactor owners, wary of the NRC's and public utilities commissions' unpredictability, are pursuing plant-life extension at less than full steam.

Researchers at equipment manufacturers, national laboratories, and universities are studying a variety of monitoring techniques. Sensors now being developed will look for signs of wear in mechanical parts. By monitoring changes in the vibrations of a pump, for example, operators can detect worn bearings before the machine grinds to a halt. Engineers are also looking at ways of sampling materials for flaws without hampering their performance. One method is the use of "materials coupons"—samples of material that are placed inside a component when it begins its service and are then removed and tested at different points over its life. Other techniques include "microsampling," where thin samples a few millimeters in diameter are cut out of a component and tested mechanically, and the use of x-rays and ultrasonic interrogation to check for cracks in high-pressure components.

Regulatory Requirements

The NRC acknowledged the importance of a strong monitoring program in its October 1989 preliminary directives for extending a plant's Operating License. In essence, these guidelines state that the NRC will allow a plant to run for as much as another 20 years so long as its owners can ensure—through a combination of performance predictions and plans for maintenance and monitoring—that the plant will continue to meet today's safety standards.

A plant's application for Operating License extension must be accompanied by a local environmental-impact report that will be used to supplement the NRC's generic environmental statement on PLEX. A round of public hearings, like those the NRC holds before licensing a new plant, will provide a forum for examining these reports along with plant safety issues. The hearings are supposed to be limited to assuring that today's safety levels will be maintained throughout extended operation; they are not meant to allow a fresh review of all the safety aspects of a plant or of nuclear power in general. But because every facet of nuclear power regulation is subject to litigation, only time will tell whether the NRC's intentions will prevail.

These preliminary guidelines are now open for review and comment. The NRC is not expected to set a definitive policy before 1993. Yet the owners of Yankee—the lead plant in the pressurized-water class of reactors—are moving vigorously to apply for an Operating License extension before then, in 1991. So the NRC's final policy is likely to be shaped by its deliberations over that first application.

As teams at Yankee and at Minnesota's Monticello

THE REGULATORY CLOCK TICKS

PLANT	OPERATING LICENSE EXPIRATION DATE	POWER (IN MEGAWATTS ELECTRIC)
Yankee	2000	175
Big Rock Point	2002	69
Connecticut Yankee	2008	582
San Onofre 1	2008	436
Oyster Creek	2009	620
Dresden 2	2009	794
Ginna	2009	490
Nine Mile Point 1	2009	610
Millstone 1	2010	660
Monticello	2010	536
Point Beach 1	2010	485
Robinson 2	2010	485

A dozen U.S. nuclear plants could be forced to cease operating by the year 2010. The owners of the Yankee plant, whose license would be the first to expire, plan to file for an

extension as early as next year. (The dates given assume that licenses are amended to expire 40 years after the start of operation instead of after the start of construction.)

$$\text{forced case: } y'' + y + \varepsilon y^3 = \varepsilon \delta \cos(t)$$

$$y \sim \frac{36}{3} \delta \cos(t) + \frac{\varepsilon \delta}{72} (-\cos(t) + 3 \cos(3t)) + \dots$$

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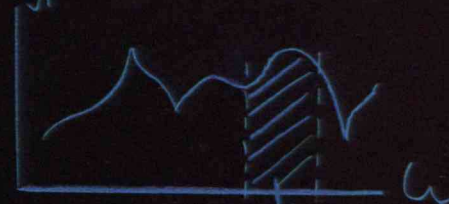
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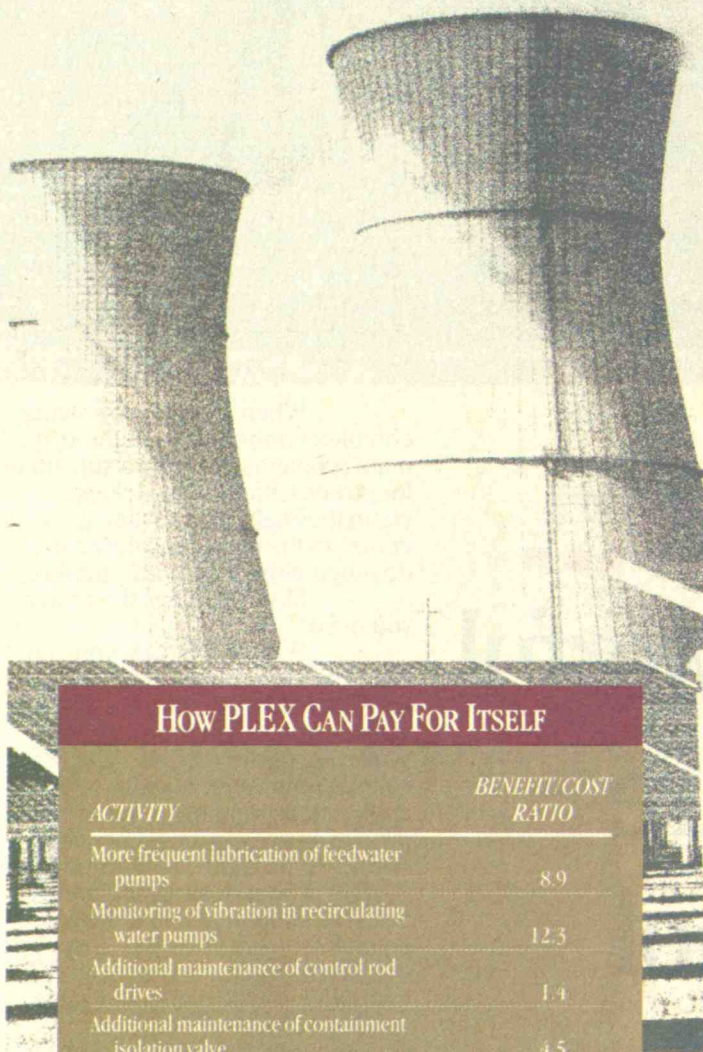
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Because of the uncertainties about plant aging, PLEX programs will have to rely heavily on monitoring sensitive components.



HOW PLEX CAN PAY FOR ITSELF

ACTIVITY	BENEFIT/COST RATIO
More frequent lubrication of feedwater pumps	8.9
Monitoring of vibration in recirculating water pumps	12.3
Additional maintenance of control rod drives	1.4
Additional maintenance of containment isolation valve	4.5
Modified testing for containment leaks	1.3
Improved monitoring of reactor vessel temperature	2.8
Early inspection for corrosion in containment building shell	289.0
Monitoring of steam-pipe wall thickness	10.3

The benefits of extra maintenance and monitoring could far outweigh the costs, according to a study of Minnesota's Monticello plant by the Department of Energy and the Electric Power Research Institute. This

is because the plant would be able to produce electricity more of the time and parts would need replacing less often. The figure under "benefit/cost ratio" is the payback on every dollar invested.

plant—the lead boiling-water reactor—work to get the needed arguments in place, other utilities are likely to await events. Analysts agree that whether or not a utility receives an extended Operating License, the upgrades necessary for PLEX can yield enough short-term benefits in improved operations to justify the expense. Yet because state public utilities commissions have often disallowed utilities' expenses in setting rates, many power-company personnel say they do not trust the PUCs to allow enough of these benefits to accrue to the plant owners. This may be an important factor in damping plant owners' enthusiasm for preparing for PLEX.

The main reason utilities are cautious, however, is that they are wary of the NRC. In setting preliminary guidelines for PLEX, the agency has been pragmatic and consistent. Nevertheless, it has gained a reputation in the nuclear power industry for being needlessly prescriptive, arbitrary, and inconsistent in setting standards for new reactors.

While giving the appearance of consistently raising safety requirements as new safety issues are discovered, the agency may actually have impaired safety by placing too much emphasis on some issues and not enough on others. For example, while focusing concern on accidents involving a sudden, large loss of coolant, the NRC had long neglected the possibility of accidents caused by small broken pipes—less dramatic but equally serious—and has downplayed human error and other risk factors that are hard to quantify.

The agency has also wrested the effective responsibility and initiative for safety away from plant owners. The NRC not only defines overall safety goals but also prescribes in detail how one may satisfy them. The utility must therefore divert resources away from work on its own safety concerns to comply with the agency's detailed directives. Ultimately, this can lead to the dangerous assumption that such compliance is sufficient for safety.

If the NRC shows signs of similar behavior in regulating plant-life extension, the whole enterprise could fall through. Thus the future of PLEX depends not only on the effectiveness with which Yankee and Monticello present their cases for license extension—and on the public's reaction—but also on the attitude of the NRC. The important questions for PLEX policy are whether the agency can maintain its balanced regulatory approach in the face of possible political opposition to plant-life extension, and whether it can formulate final criteria and procedures in a timely fashion. In view of impending capacity shortages, the answer to both questions ought to be yes. ■

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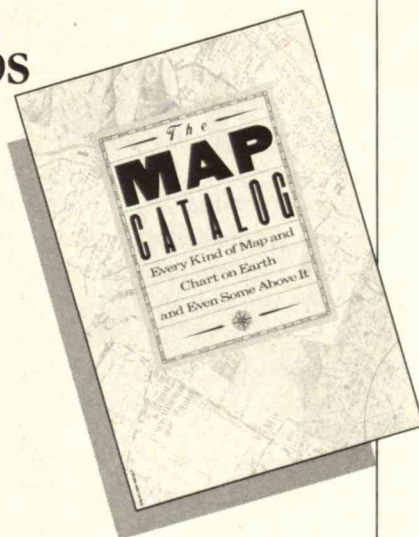
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After the Wall

An Interview with Benno Parthier

BY SARAH GRIFFEN

LAST year, Eastern European governments toppled like dominoes, giving way to great uncertainty amidst rapid change. In early October, people in the German Democratic Republic (GDR—East Germany) took Mikhail Gorbachev's policies to heart. Following the lead of Poland and Hungary, they began demanding democratic reform. As a result of mass demonstrations throughout the country in October and November, government authority disintegrated, head of state Erich Honecker fell, and the borders to the West opened wide.

Such rapid upheaval has paved the way for changes in every aspect of GDR society. In the world's tenth most industrialized country, changes in science and technology are particularly significant. For 40 years, a centralized bureaucracy that was socialist in name only controlled these endeavors.

**A leading biologist
in the German
Democratic
Republic com-
ments on how
political upheaval
is changing the
practice of science.**

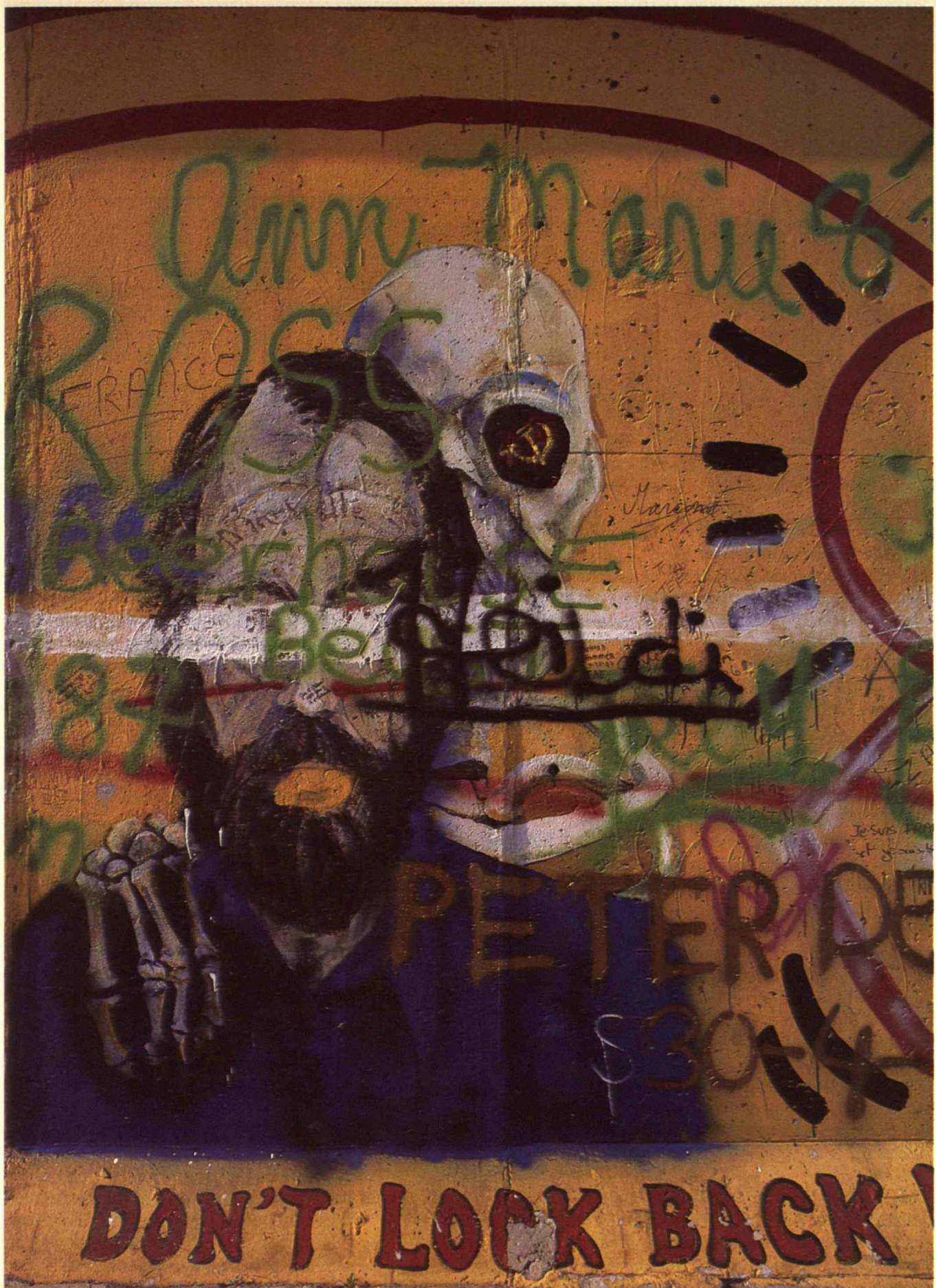


Typical of planned societies, decisions on the content of scientific inquiry were made at the highest levels of government.

Science and technology were part of a greater plan, established every five years, that allocated resources and established guidelines for production and growth. Department heads at universities and research institutes, usually members of the predominant Socialist Unity Party (SED), ensured that the plan was followed.

Benno Parthier, an internationally known plant physiologist and biologist, was an exception to the rule. Although he never joined the SED, since 1968 he has headed the Department of Molecular Biology at the Institute of Plant Biochemistry in Halle, a division of the Academy of Sciences.

Parthier is also president-elect of the German Academy of Nature Research, Leopoldina, Europe's oldest academy of natural sciences. Founded in 1652 in Schweinfurt, the Leopoldina consists of scientists from



all over the world, although most live in German-speaking countries. It has been located in Halle for over 100 years. Its members are elected on the basis of "their scientific qualifications and their personal integrity but never their political beliefs," Parthier explains. Membership is considered a great honor.

The Leopoldina plays an important role in the GDR as an independent academic society that organizes congresses, symposia, and meetings. Its library contains a quarter-million old and modern books in science and medicine, which are available for public use. The academy attracts outstanding people, among them many Nobel Prize winners, in its efforts to bring first-class science into the GDR and to stimulate students and young scientists.

Sarah Griffen interviewed Parthier for *Technology Review* in late January at his home in Halle, two hours south of Berlin. At that time, the GDR was absorbed in the elections that were finally held on March 18. As Parthier commented then, "Everybody is staring at the election day like a rabbit stares at a snake. We now have an election campaign, as nobody has known for the last 40 years."

In the election, the main issues were unification with the Federal Republic of Germany (FRG—West Germany), the structure of the economy, ecological safeguards, and retaining the GDR's comprehensive social programs. But fast-moving events have made unification seem inevitable, and many in the GDR have been alarmed that their guarantees of work and a basic income might disappear if the FRG simply swallows its smaller neighbor. Calls for democratic socialism, heard in the fall, have been replaced by voices demanding the joining of the two Germans.

What would unification mean for science and technology? And what changes have already taken shape in these fields? Parthier provides some insights.

TR: Before last October's mass demonstrations forced the ouster of the government, did the state intervene in the activities of scientists?

PARTHIER: In general, the politics of the Socialist Unity Party intruded strongly into science. The freedom of science that you usually have in a democracy did not exist or existed in name only. That applied to

universities as well as to the GDR Academy of Sciences. The SED controlled all the academies by appointing party-bound directors in almost every case.

I used to call it command science. If scientists in the institutes were not very strong, or if they were unwilling to accept the personal consequences of dissenting, they would be led by the nose by the party to work only on problems that were of importance for the economy. For example, chemical institutes were forced to synthesize novel compounds for pharmaceutical and agrochemical use, and plant research institutes had to test them for biological activity. In a small country like the GDR, perhaps that was necessary.

One of the obvious obstacles to science was that many young scientists were not allowed to travel. Like all other people in the GDR, scientists were divided into two classes: those who could travel and those who couldn't. The number of those not allowed to travel was much bigger than those who could.

Young people who weren't married and therefore might not return if they traveled to the West were especially frustrated. They couldn't get their credentials and training at the leading scientific institutions of the world but had to stay in the GDR. This frustration resulted in less work by these scientists—both as a form of protest and because they had no motivation to work more. This was really harmful for science in the GDR, as was decreasing government support for basic research.

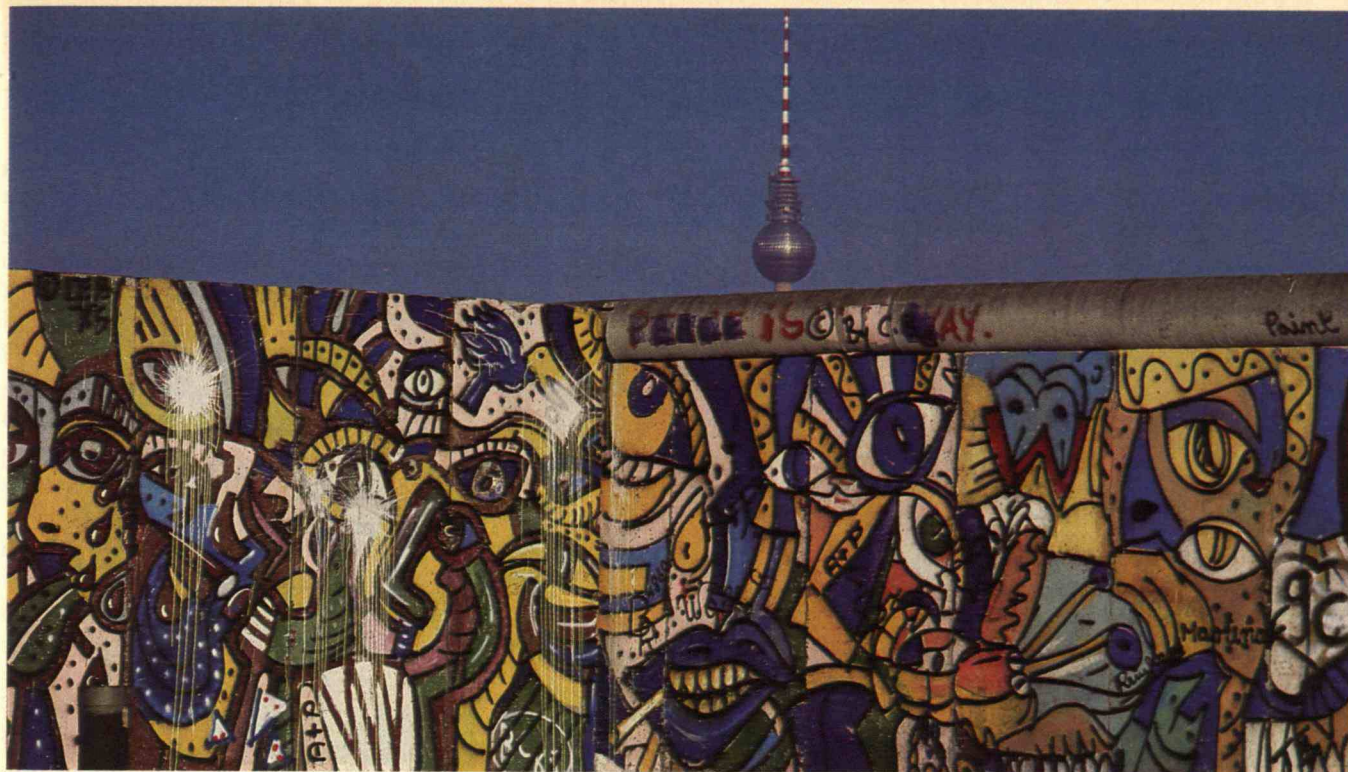
Promotion was restricted to an exclusive circle of people by the so-called *Kaderplan*. That was a long-term plan for personnel development and promotion, much like a five-year plan for individuals. The people who were to become heads of departments were determined at a very early stage of their careers, based mostly on party membership.

TR: Were there other ways that the SED hindered scientific activities?

PARTHIER: It didn't hinder them directly, but indirectly through selecting certain people who perhaps weren't the best scientists but were placed in positions because they were members of the SED. That happened a lot. The proportion of party members who became professors was much higher than the proportion among the

The people who were to become heads of departments were determined at a very early stage of their careers, based mostly on party membership.





general scientific population.

However, direct hindrance would have been unreasonable because those in the SED would have cut their own throats. They did want science to have high standards, but the means toward this goal were wrong.

TR: In what ways was the structure of scientific research in the GDR influenced by politics?

PARTHIER: Science had developed through its function as a servant for the economic welfare of the state. It had to carry out what nonscientists demanded.

We have a ministry of science and technology that coordinates most research activities. It indirectly rules the institutes of the academies as well as the technical universities and other research institutions. This ministry was advised by various scientific councils, but a number of them weren't very effective. Often the directors of institutes had enough power to ignore the councils' recommendations, so their

democratic function was not implemented. Usually the only things that went through the council were things that the Politburo had promoted. This meant a strong politicization of science, in the sense that the guidelines were determined by politicians more than by scientists. Hopefully this is over, and the opinions and advice of scientists will weigh more heavily in the future.

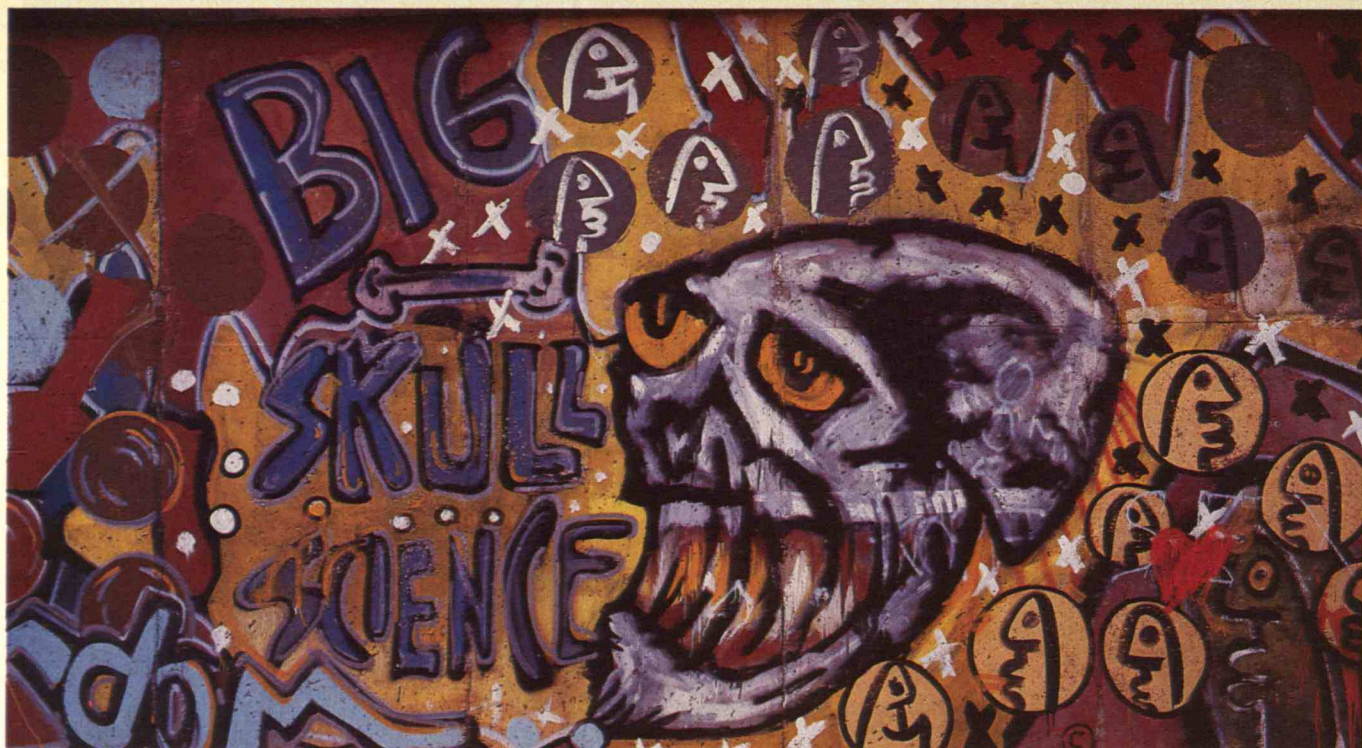
Science and Social Change

TR: What is the level of technology in the GDR? What's the base for future development?

PARTHIER: Although the GDR's technological base is lower than in the leading industrial countries, it's still comparable to that of smaller developed countries such as Switzerland, the Netherlands, Belgium, and Sweden. But it's not the quantity, it's the quality that makes the difference. Factories and enterprises like Bayer or Hoechst in the Federal Republic of Germany or Ciba-Geigy and Sandoz in Switzerland, to mention only a few examples, had all established their own research even before World War II. Enterprises in the regions that became the GDR had their own research programs too, but these were des-

For years, artists have covered the western side of the Berlin Wall with political and non-political murals. The Wall is coming down, as are the barriers that have separated science in the two Germanys.

SARAH GRIFFEN is a graduate student in urban planning at MIT. She has traveled extensively in Eastern Europe and for six years has been a guest lecturer and teacher in the GDR for the Ministry for Education and at the University of Jena. She is on the staff of Women for Economic Justice and is an editor of Dollars & Sense magazine.



stroyed after the war and not rebuilt. As a result, industry, which can renew itself only with the help of science, had no research of its own in the GDR, or very little. Some such scientific activities had to be carried out at universities and academy institutes, but with only moderate success. I can't judge physical and technical fields well, but in biotechnology, biochemistry, and pharmaceuticals, the ratio between spiritual input and economic efficiency was low compared with that of other European countries.

Also, in the capitalist system, a lot of basic science is done in the big industries. And some large-scale project research is carried out in cooperation with universities, such as MIT and California's many campuses. Thus, an incredible collection of scientific intelligence has accumulated in certain places. Good scientists, good developments, reinforce and encourage each other. The more people that compete and discuss, the faster and better science develops.

This didn't happen in the GDR. The universities existed as wallflowers in science and technology. The technical university in Dresden has an international reputation and is a place where good specialists have been trained, and there are some other reasonably good institutions—for example, the technical college in Ilmenau. But the real difficulty is that the people trained

in these institutes often didn't know how to relate their knowledge to the technological processes in industry. Therefore, there wasn't a harmonious transition between training and work.

One should remember that no new universities have been established in the GDR in the last 40 years. Some medical academies and technical colleges were built, but we still have only six classical universities in the country, all over 200 years old. In comparison, many new universities were founded in the FRG after the war.

TR: How is the organization of scientific and technological work changing now?

PARTHIER: Science in the GDR will be strongly influenced by an increased demand for efficiency in most of the research institutes and for better education at the universities. In the last decade, scientific quality—that is, the publication of research findings in journals of high international standing—dropped. Mediocrity became common for the reasons I already mentioned. More demands will be put on the institutes and universities to improve the quality of research and training, but that will require a lot of support.

TR: Where will that support for research and training come from? Will the govern-

ment provide all research money, as before?

PARTHIER: I think it can't, because the state will need a lot of money for other purposes, especially in the present state of reconstruction. But each industrialized country has to spend a reasonable amount of its budget for basic science, at least by financing salaries, investments for new buildings and equipment, etc. The funds for research could come from grants from sponsors inside and outside the country. Our present funding system has to be improved. Maybe, for example, competitive sports won't get so much.

Enterprises that are interested in a specific research activity will have to start building up their own research groups, which can then cooperate with the institutes at the academies and universities.

TR: How do you think the democratic views being expressed throughout the GDR will be reflected in science?

PARTHIER: We must have more democracy that comes from below, so that people at the bottom of the ladder have a direct say in who leads an institute. Scientific councils, somewhat like trade councils, will be formed. They will have the right to participate in decisions on the appointment and replacement of directors or department heads. That would motivate younger scientists by giving them opportunities for a good career and fast promotion.

TR: Have the various academies begun adapting yet?

PARTHIER: I think that scientists and scientific institutions are relatively conservative. Science is a conservative institution in general because it can't easily throw away concepts that have been proven. Thus, after the October Days, the Academy of Arts of the GDR reacted very quickly, but the Academy of Sciences did so much more slowly, and the Academy of Agricultural Sciences has not reacted at all to date.

But now we must spend a lot of time thinking carefully about real changes. Thus, in these academic institutes proven principles of leading scientific organizations will be introduced. For example, the Max Planck Institutes constitute a very competent research community in the FRG and in West Berlin, sometimes compared

with that of the bigger Academy of Sciences in the GDR. In my opinion, the former are much better equipped and organized and are much more efficient in research with fewer personnel.

At the Max Planck Institutes, one can either appoint or elect department heads. The heads are often in a rotation system and can become directors of the whole institution every three or four years. This system is certainly more favorable for science for democratic reasons than a strict management structure, the kind of pyramid that has been typical in German universities in the past.

One should not generalize. Whether one form or the other is preferable depends very much on the personality of the individual director. There are institutes at the Max Planck Society that are dominated by one outstanding personality and that do very well. But until October, every institute of the academies in the GDR looked exactly like the next in structure.

Scientists and Politics

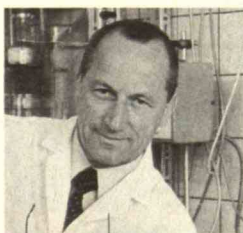
TR: What role are scientists playing in current political events?

PARTHIER: There were always scientists that were politically involved before October 1989, and many naturally were not. Those who were involved in the SED earlier probably won't be interested in politics under the new conditions, or they may not have the opportunities to implement their ideas in the new society because of their past party membership. But it is possible that young scientists will become involved in politics right now because there is such a lack of personnel to build new structures in industry and politics. I know some—a few—who think about leaving science and entering politics. Some of them might become professionals in politics by joining newly formed parties, where they will fill a vacuum for people with modern democratic visions. Hopefully, they will also advise the administrators of the necessity for science development.

TR: The shortage of trained personnel could be critical, with scientists emigrating both before and since October. What have been the reasons for leaving?

PARTHIER: Before October, some scien-

More demands will be put on the institutes and universities to improve the quality of research and training, but that will require a lot of support.



tists didn't see any chance to pursue their career because they weren't in the right party, or because they didn't want to meet some of the expectations of the SED. Fewer left for the West for purely scientific reasons. Those scientists thought that the scientific opportunities and working conditions in the FRG, in Western Europe, and in the United States were much better. I think this group was the smaller one. Some also left for political reasons even though they are scientists.

The situation after the October revolution and the opening of the Wall is different. Technologically oriented scientists have many job opportunities in the West European countries and West Germany. But the classical scientists from universities and institutes, especially those over 40, have hardly any opportunity to find a job elsewhere. The jobs at universities in other countries are more or less occupied by better-trained scientists, so maybe most of our younger people will stay here now. However, they need motivation for scientific work. The danger of an exodus in classical science, even if the economy doesn't improve in the next few years, is not as great as for professions such as technical science or medicine.

If scientific opportunities get better here, well-qualified people will be more likely to stay. The financial side will remain problematic, because a scientist in the GDR earns one-quarter to one-third the income of a scientist in a similar position in the FRG. This may be a reason some have left, although they have to pay more for rent and for general living expenses in the FRG.

TR: Do you expect science in the GDR to suffer a serious brain drain now that its borders are open?

PARTHIER: Yes, it could happen if you look at it qualitatively rather than quantitatively. Fewer are leaving but those who leave are the best young scientists. This danger will persist. For example, it has existed for the FRG, whose scientists go to the United States even though the two political systems are very similar. Scientists who are scientists by calling and want to do excellent work and to be exposed internationally leave the FRG, too. You can't do anything about it. We can only hope that these people will come back when things are better here and science is well supported.

A

scientist in the GDR earns one-quarter to one-third the income of a scientist in the FRG. This may be a reason some of them have left.



Rebuilding Science

TR: What are the biggest challenges in the sciences in the GDR now?

PARTHIER: The social and political sciences will have to undergo a complete change; there will be a small earthquake. Ideology has to be converted to science. The whole historical science and philosophy, as far as it was covered by Marxism-Leninism, will change greatly. The teachers have to be changed; new young people must take over.

For natural sciences, the continuity is, of course, naturally greater. They can't easily throw away proven concepts. The rectors and pro-rectors of the universities and section and department heads have not generally been replaced yet, simply because continuity requires them to stay until democratic elections take place. Of course, that is sometimes a hindrance—the administrative structures also remain, and they are being changed very hesitantly.

A major problem is the weak infrastructure for science. The equipment at the institutes is incredibly outdated. Because of the formation of big industrial state corporations in the GDR after World War II, the whole system of medium-sized enterprises that could specialize in building special equipment and facilities was destroyed. In the West European and North American countries, these small and middle-sized industries have been important for the development of modern science. We haven't had these in the last 20 years in the GDR. The state corporations were not able or didn't want to produce things that science needed, so the innovations that are the reason for the superiority of West European institutions haven't occurred in the GDR.

Only in recent years—under pressure and at great financial cost—has a micro-electronics industry developed. Unfortunately, this was at the expense of other sciences. Now medicine, the natural sciences, and the social sciences are far behind by world standards. A lot of money, especially convertible currency, will be needed to renew these fields.

TR: As the GDR develops, won't it have to address environmental questions more?

PARTHIER: Any visitor from abroad coming to Halle or Leipzig smells the uncontrolled emissions from the outdated

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chemical factories and from burning coal. The cost of significantly improving the air will be many billions of dollars, either to modernize the polluting industries or to improve pollution controls. The water in the Elbe and Saale rivers is extremely polluted. That of the Saale resembles a chemical broth, devoid of fish or water plants. Some phenyl-oxidizing bacteria may be the only living things in it.

Industrialized agriculture made remarkable progress in producing field crops but at the expense of protecting nature. The lakes are laden with phosphates, nitrates, and heavy metals. Their typical flora and fauna have changed, and the soil is polluted with nitrogen fertilizer, herbicides, and pesticides.

In the past, all the figures about environmental pollution were top secret. Although scientists pointed to the problems, their complaints did not reach the ears of the former governments. This must and will change in the future, but it is an expensive task.

I hope that we can keep from shifting the ecological problems that have arisen through industrialization to Third World countries. But we already see them in Brazil with the deforestation in the Amazon. We don't know yet what global ecological problems will arise from that. And then there is the greenhouse effect. Hopefully, it won't be as dangerous as journalists now claim, but undoubtedly it is a big problem.

We should not forget that because of the revolution in central Europe, a really burning problem of the world—the North-South problem—has vanished from the headlines. The material problems of Poland and the Soviet Union are enormous, but if democracy continues to be built in Eastern Europe, then the main focus will turn to the Third World again.

TR: Where do you as a scientist see the political situation in the GDR heading now?

PARTHIER: It is difficult to say. The polarization among the population is increasing. The old positions of power are still there. The SED, with about 1.2 million members at present, is still by far the biggest party. And there are many opposition groups, all claiming to be ecological and social, and all wanting, sooner or later, the unity of Germany.

Although scientists pointed to environmental problems, their complaints did not reach the ears of the former governments. This must and will change.



I think the Social Democratic Party has made the most progress in forming a party—although to keep my personal independence, I am not a member and probably won't become one. If you get involved either in science or in politics, you should do it wholeheartedly. There is not much of my daily life left for involvement in politics.

TR: How would the unification of Germany affect science in the GDR?

PARTHIER: Cooperation between institutions in the GDR and the FRG has already started in fields of mutual interest. It is based partly on contracts. For example, a contract between the German Research Association in the FRG and the Academy of Sciences in the GDR will promote basic research of mutual interest. In addition, the association will generously support new common research projects between scientific institutions of the FRG and GDR. And private sponsors will give money. For example, the Volkswagen Foundation in Hannover plans to promote and financially support East German and West German projects in all fields of basic research. These joint-work agreements had begun before October but only on paper. Now they are becoming reality. Before, both sides were quite hesitant.

We have to expect that the exchange of scientists for longer periods will also increase considerably, and that scientists from the FRG will hold key positions as professors at our universities and vice versa. We would also have the opportunity to equip our institutes better than before. A single currency would make it easier to buy things—like modern computer-aided apparatus, biochemicals, and radiochemicals—that we can't now.

I think that research fields in the GDR based on historical and humanistic science, as well as certain branches of classical physics, biology, and biochemistry, achieved noteworthy results despite the limited research possibilities. These may be the stocks for future common projects.

Unity is certainly better for science, simply because science in the GDR will then face free competition from international science, and unity will give the GDR easier access to institutions in the FRG. Fair competition is a prerequisite for development and progress, not only in economics but in science as well. ■



*Though music
retains its
hold on MIT
students, a
new rationale
for the arts
prevails on
campus.*

—page MIT 5

MIT in the Schools

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COVER

Is there an alumnus or alumna who couldn't guess by now that our cover "artist" is a member of the MIT Concert Band, suited up for the annual Halloween concert in Lobby 7? While the arts at MIT are a diverse mix, music continues to attract more student involvement at every level than any other medium. (Photo by Robert D. Newman, '89)

In his otherwise fine article "MIT Reaches Out to the Public Schools" (February/March, page MIT 8-17), David Hamilton states on page 10: "The program was designed to bypass students' natural resistance to scientific theory by making the learning exciting and painless." Although it may not have been Mr. Hamilton's intention, this sounds suspiciously like what might be called a *Sesame Street*-like philosophy: that learning is inherently boring, that children are inherently mentally lazy, and that therefore learning is best achieved by tricking the learner into learning. In fact, the reverse is true: children are born avid learners, and learning is inherently exciting. What happens to many children is that boring textbooks, uninspired teachers, and unsupportive parents combine to extinguish their in-born love of learning.

This point is of great importance. Children have an uncanny knack for discerning underlying messages. If we trick children into learning science, short-term victories will be succeeded by the long-term message that science is dull, as compared to the vehicles—videos, magic shows—that deliver the lessons. If we remind ourselves that others can love science just as we do, the proper message will be conveyed.

DANIEL REINHARTH, '74
BERNICE MEDNICK REINHARTH
East Meadow, N.Y.

Among the programs described in David Hamilton's article on MIT in the schools is the one we founded, the MIT Chemistry Outreach Program. Although we appreciate the publicity, we feel the need to address several inaccuracies and omissions. First, the *Journal of Chemistry Education* 1989, 66, 668 (the August issue) is the correct reference to our paper. A more fundamental error concerns Hamilton's statement, "A team of five undergraduates took over the program in the following year." It was a group of four MIT graduate students who continued the program in the following year. Our intention from the very inception of the MIT Chemistry Outreach Program was that a new group of interested and enthusiastic graduate students carry on in each following academic year, and this is indeed how the program has progressed.

We also take exception to Hamilton's

characterization of us as "brainwashed" and "converted" to the opinions of our graduate advisor, Professor Rick Danheiser. Our interests, motivations, and ideas for developing this program stem from our own independent and long-held concerns about the quality of pre-college science education, many of which are mutually held by our advisor as well as most members of the scientific community. That we could not have developed the MIT Chemistry Outreach Program without the generous permission of Professor Danheiser is not at issue; however, we were acting of our own volition and not as surrogates of Danheiser.

Finally, we must correct a glaring omission on the part of Hamilton. Without the full support of Chemistry Department Chairman Mark Wrighton as a source of contacts, as a cosigner on several mailings, and as the source of funds to purchase supplies, this program could never have succeeded.

RONALD G. BRISBOIS, G
JAMES S. NOWICK, G
Cambridge, Mass.

The substitution of undergraduates for graduate students was an error introduced in the editing process, not an error in David Hamilton's manuscript. Mea culpa.—Ed.

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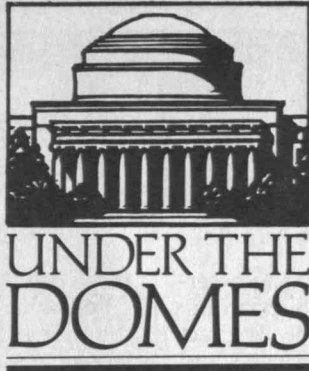
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Presidential Search Continues

After a brief period of excitement in mid-February, when the nomination of biologist Philip Sharp to be the 15th president of MIT was announced, the search for a president is on again. A week after the decision of the Corporation Committee on the Presidency and the Faculty Advisory Committee became known, and a week before the full Corporation was to vote on his nomination, Sharp withdrew his name from consideration.

Sharp, who is the John D. MacArthur Professor of Biology and director of MIT's Center for Cancer Research, is best known for his discovery of surplus DNA and the splicing of RNA.

As both MIT and the biology community were buzzing with the news of his nomination, Sharp was having serious second thoughts about the prospect of giving up his research to devote himself full-time to the presidency. In his letter to the Executive Committee of the Corporation, Sharp said that he was honored and challenged by their recommendation. However, "as I anticipated dissolving my research program and teaching duties, I came reluctantly to the realization that I could not fill that void in my life with anything else." He apologized for his indecisiveness, and expressed his full support to

MIT and its next president.

The buzzing turned to murmuring at this unexpected turn of events, but as Faculty Advisory Committee Chairman Robert Solow put it, "Everything is exactly as it meets the eye." When initially accepting the nomination, said Solow, "Phil had been prepared to give up his research—but when the moment came, he was unable to make that sacrifice. There is no hidden agenda." We continue the search, Solow said, "sadder but wiser. Our instructions are not to rush the process—we'd like to come up with a new president as quickly as possible, but we will not sacrifice anything to haste."

At a meeting of the faculty shortly thereafter, President Paul Gray, '54, said that if the Corporation asked them, he and Corporation Chairman David Saxon, '41, would be willing to stay on in their posts, saying "MIT will not fall off a cliff on July 1." That was the day that Gray was to succeed Saxon as chairman. Provost John Deutch, '61, who was scheduled to return to full-time teaching and research, has also expressed willingness to stay in his post until the new president can appoint his successor.

In his remarks to the faculty, Gray said, "More than one person in this room has heard me say on various occasions in the last year or so that it has taken me 20 years to come to understand that the best job in the university is professor. Phil Sharp is obviously a quicker study. I have confidence, however, that there are out there a few

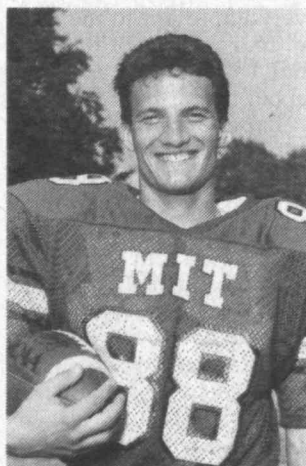
good women or men who will be as slow as I was to learn this."

At the quarterly meeting of the Corporation on March 2, the Institute's trustees authorized resumption of the search for a president and the extension of Gray's and Saxon's terms of office. No deadline has been set for a new nomination. □

Gridiron Wonder

Every good wide receiver has a combination of soft hands, decent speed, and intense concentration. A bit of faith in his own abilities in the form of self-confidence also helps. Faith on a higher plane can't hurt either.

Anthony Lapes, '90, of the MIT Beavers is the premiere receiver in the 12-year history of MIT football. The 1986 Dalton (Ga.) High School graduate took some time to get on track after he arrived at the Institute, but



Anthony Lapes, '90

since mid-season of 1988, Lapes has been an unstoppable force.

"Anthony's ability both to get open and to catch the ball in traffic allowed us to diversify our offense in a number of ways," MIT Head Coach Dwight Smith says. "Even when he was double- and triple-covered, if the ball was there, he'd catch it. [Ours] having been a run-oriented team for years, adding Anthony's skills to those of our quarterback made us a much more difficult team to defend against."

That difficulty for opposing defenses manifested itself in points on the scoreboard. MIT scored 45 and 39 points in its first two wins this season on the way to a single-season Institute record of 210 points scored.

Lapes is one of the main reasons. The senior hauled in 25 catches for 473 yards and five touchdowns. He led the conference in yards gained receiving and was fourth in catches per game.

Lapes' domination of the MIT record book makes one want to ask why he isn't playing at a higher divisional level of football. Surely Division II or I AA would be a possibility.

"I honestly think I could have played at a 'higher' level," Lapes explains, "but my education came first. The opportunity to play at a competitive level in Division III is what I wanted as part of my college experience."

Lapes almost missed that opportunity. He contracted mononucleosis during the summer following his senior year in high school and doc-



tors would not allow him to play his freshman year.

When he resumed playing sophomore year, the positive results were not instantaneous. Lapes caught 20 passes that season, averaging just over two catches per game. At mid-season his junior year, however, his production was minimal.

That's when the faith on a higher plane kicked in.

"By halftime of the Stonehill game things hadn't been going well all year. I had only four catches to that point in the season. I knelt down just before we went back on the field and said, 'Lord, I play this game for you, to bring honor to you. If my playing doesn't do that, then there's no reason for me to continue.'"

Lapes caught fire after that. He grabbed six passes in the second half, and in the final three games of the regular season pulled down 22 tosses. His performance was capped by an 11-reception, 225-yard, 3-touchdown day in the season finale against Bentley College. His efforts earned him every single-game, single-season, and career receiving record at MIT following only two years of competition. He was named a first-team, All-Conference selection in the now-defunct New England Collegiate Football Conference, was a first-team Sigma Chi Fraternity All-America, and was a pre-season Honorable Mention Division III All-America in 1989.

"I'm convinced my Christian faith has meant a lot of difference between my being a better-than-average player rather than an average player," he says. "If I had to point to one thing during my time at MIT, that

would be it. Having a certain tranquility through my faith is important. The fact is, football is a game and should be enjoyed. That's the purpose of playing."

A joint major in computer science and math with a literature minor, Lapes has not allowed football to intrude on his class work. He has a cumulative grade point average of 4.6 out of a possible 5.0, and earned a perfect 5.0 in the Spring Semester, 1989. He was recently one of only 22 players nationwide to be honored as a National Football Foundation and Hall of Fame Scholar/Athlete, one of the most prestigious awards in college football.

Lapes' crowning achievement came in January of this year, when he received the Woody Hayes Award for Athletic Ability, Scholarship, and Leadership as the outstanding male in Division III sports. It is the highest award ever given to an MIT athlete.

"The type of football we play is the kind I work well in. There's no pressure and no hype. We just go out and get the job done," Lapes says. "My entire life is not dedicated to football. It's very important to me three or four months of the year, but I don't have to worry about it year-round."

Lapes' contributions at MIT go far beyond the football field. He is president of the Institute chapters of Campus Crusade for Christ and Sigma Chi fraternity. He works in the Department of Mathematics as a tutor and professor's assistant, and has served as a representative to the student government.

Lapes knows he is blessed with physical talent, but he offers encouragement to

those who may not be as gifted as he: "If a person has the desire, he shouldn't let lack of size or speed stand in his way. If you have the desire to achieve in athletics that's far more important than physical skills or attributes."—Roger Crosley □

The author is director of sports information at MIT.



10K Contest Attracts Young Entrepreneurs

The friendly rivalry between the Schools of Engineering and Management at MIT was put aside for this term, as student groups from the respective schools joined forces to organize what they hope will become an annual contest to identify the best new business ideas on campus. Judging from the success of this inaugural competition, a repeat of the contest seems likely.

The MIT Entrepreneurs Club and the Sloan New Venture Association co-sponsored the 10K Entrepreneurial Competition this spring, with a \$10,000 prize going to the winner. The goal of the contest, according to its organizers, is not only to identify and award

good ideas, but to stimulate community interest in entrepreneurial activities. They also hope that the contest will help students interested in going into business for themselves to find each other and learn about the benefits of working together.

"There are a lot of smart people here with good ideas," says Andy Blanchard, a Sloan master's degree candidate and one of the organizers of the contest. "We'd like to encourage those people to go forward with their ideas, and we hope that they'll use the prize money to launch their idea into a product or company."

The contest has garnered support both from within MIT and from the Greater Boston business community. Contributions of funds and services came from Burr, Egan & Deleage, Software 2000, Inc., Thermo Electron Corp., Price Waterhouse, Regis McKenna, Inc., Sullivan & Worcester, Bitstream, Inc., the MIT Enterprise Forum, the MIT Technology Licensing Office, and the Schools of Engineering and Management.

The contest is open to all registered MIT students, and has two judging phases. In phase one, contestants were asked to submit an "executive summary" of five pages or less that encapsulates their idea. The judges and the contest organizers signed non-disclosure statements to protect the contestants' ideas. The judges are prominent members of the Boston business community: John Flint of Burr, Egan, Deleage; Joseph Hadzima, Jr., '73, of Sullivan & Worcester; John Preston of the MIT Technology Licensing Office; and Joseph

Marvin Minsky

Tibbets, Jr. of Price Waterhouse.

A campus-wide promotional blitz attracted 64 entries, evenly divided between engineering and Sloan students. "People put a lot of work into their entries," said Douglas Ling, SM '87, one of the co-founders of the MIT Entrepreneurs Club. "Both the quality of the ideas and their presentation showed that the students took the exercise seriously."

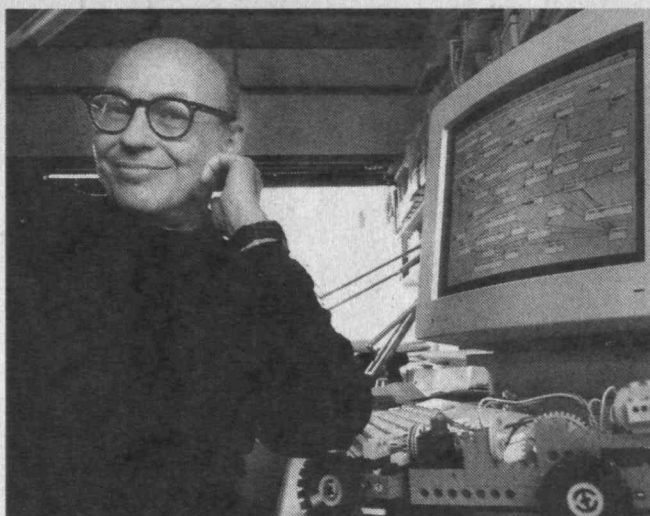
The judges evaluated the executive summaries from the point of view of a venture capital firm picking selections for its portfolio of companies, and they provided written feedback as they reviewed the entries. The goal was to give the students a sense of what it would be like to sell an idea to professional investors, says Ling.

Eleven of the entries were selected to go on to phase two. Those contestants have been asked to write full business plans, from which the judges will pick the grand prize winner.

The grand prize of \$10,000 is to be awarded in May. "All of the entries in the final round have the potential of becoming highly successful businesses," says Ling. "Ideally, we'd like to fund them all." □

Minsky Wins Japan Prize

Marvin L. Minsky, co-founder of MIT's Artificial Intelligence Laboratory, has been awarded the Japan Prize for 1990 in the field of technology of integration. He was cited for the "establishment of artificial intelligence as a



new discipline and the proposal of its fundamental principles."

Awarded by the Science and Technology Foundation of Japan since 1985 under the auspices of the Japanese prime minister, the prize is given to scientists who have made original and outstanding contributions to the progress of science and technology and the promotion of peace and prosperity of humankind. A second Japan Prize is to be awarded in the field of earth science.

As a recipient of the Japan Prize, Minsky will receive approximately \$350,000 (50 million yen) at a ceremony in Japan on April 17, and deliver lectures in Tokyo and Osaka on the extent to which the computer can approach human intelligence. He will also participate in an academic debate involving some 20 scientists in his field.

Minsky, the Toshiba Professor of Media Arts and Sciences in the Department of Electrical Engineering and Computer Science, has a broad range of interests in mathematics, engineering, and computer science. He is one of the few scholars to be elected a member of both the National Academy of Science and the National Academy of Engineering. Minsky is a founder of General Turtle, Inc., Logo Computer Systems, Inc., and

Thinking Machines Corp. He has been an advisor to NASA and the National Dance Institute. □

T-DAY Debate



"I consider that there is a better than 50 percent chance of 2°C or more warming in the next century (which would be unprecedented in the era of human civilization) and that nothing raised by the critics in the past few years has substantially changed that probability." So says Stephen Schneider (above) of the National Center for Atmospheric Research. MIT Professor of Meteorology Richard Lindzen (below) disagrees. The two camps square off June 8 in Kresge Auditorium.



CALENDAR

May (TBA)
Productivity Commission
"Road Show"
—Washington, D.C.
—Houston, Texas
Contact: Bob Blake
(617) 253-8243

May 10
AMITA Annual Meeting
Contact: Nancie Barber
(617) 253-8217

June 4, 10am
Commencement
Speaker:
Virgilio Barco, '43,
President of Colombia

June 6-10
Alumni/ae Week,
Reunions

June 8, 9am-noon
Technology Day
"Is It Getting Hotter or What?"—a Debate on Global Climate Change
Contact: Eliza Dame
(617) 253-8230

June 7-9
Department of Earth, Atmospheric and Planetary Sciences Centennial Celebration
Contact: Jane Grussing
(617) 253-8241

June 30
FY90 Alumni Fund Year Ends

September 15
Alumni Leadership Conference
Contact: Eliza Dame
(617) 253-8230

All events held on the campus in Cambridge unless otherwise noted.





The Arts at MIT

A New Champion A Renewed Mandate

BY DEBRA CASH

For months after she'd arrived at MIT, Ellen Harris still hadn't gotten around to hanging any pictures on the walls of her new office. The low sofa and desk were arranged to take advantage of the glorious urban riverscape along the Charles, but except for a stack of musical scores among the memos waiting to be read, it would be hard to know that Harris' office was the new hub of MIT's artistic mandate.

Intentional or not, the message sent by the office of MIT's first associate provost for the arts reflects a certain openness. She herself admits that these early days are a time not to implement any agenda she packed in her luggage when she left Chicago, but are instead a time to listen, to observe, to be receptive to whatever might turn out to be meaningful.

For the first time since the fundraising for the Wiesner Building began in the early 1980s, there's a lively discussion underway of the role of the arts at MIT. In the fall of 1987, Professor of Economics Paul Joskow released his committee's report on the status of the arts at MIT. The report crystallized certain themes, addressing issues such as undergraduate education, the standards for appointments to the arts faculty, and the desperate need for facilities. It tabled other concerns, including graduate arts programs and the much-debated role of the



Ellen Harris

Media Lab—home to experimental music, holography, graphics, video, and film—in the community.

In the course of its 104 pages, the Joskow Report also outlined a job description for the arts' new champion. The committee called for an associate provost, "a senior administrative official who is also a faculty member in either the performing or visual arts [who would] take a broad responsibility as an advocate, leader, and coordinator of the creative arts" at MIT.

Harris' hiring is a milestone, something against which to measure a *before* and an *after*. Initially, some skeptics speculated that the creation of an associate provost would be a crumb thrown to campus arts supporters, a smokescreen masking a continued delay in allocating much-needed funds. Yet the arts on campus are already assuming a higher profile, and Harris, if not herself the catalyst, symbolizes their enhancement.

When Dean of Social Sciences and Humanities Anne Friedlaender, PhD '64, first wrote to ask Harris to consider the MIT post, the University of Chicago musicologist was not interested in moving. A soprano specializing in the work of Handel, Harris was happily ensconced in her job, had graduate students to supervise, and, with her husband, a computer consultant, was raising their two daughters in a Chicago



A photographer and lecturer at MIT, Richard Bolton won considerable attention for his mixed-media installation at the List Visual Arts Center titled

"The Bear in the Marketplace: Anticommunism and Patriotism in Recent American Advertising." Bolton describes advertising as "the loudest voice in

our lives," and says that "anticommunism and patriotism have been used as a marketing device for everything from clothing to cigarettes."

suburb.

But Friedlaender's letter wasn't the usual request that Harris consider heading a university music department. It had a unique twist: the opportunity to work for a level playing field for the arts at an institution where everybody else plays on a mountaintop. Intrigued, she felt that at least she should come to Cambridge for an interview. It was an opportunity she and her family decided was worth the move.

"What struck me so powerfully is that MIT is what it seems," Harris says now. "There is no false advertising. The aura of creativity on campus is overwhelming. MIT turns out to be the perfect place for the arts because of its emphasis on hands-on work and invention."

She also found a balkanized arts community, one in which "the arts flourished in pockets, but [its practitioners] had not spoken to one another in ways that would strengthen them."

"You can't slap a prefabricated plan on top of MIT, and I'm not interested in creating a school of the arts," Harris states categorically. "Arts programs have to be an outgrowth of what already exists. I don't want to tamper with what's

here. I want to build on it."

A number of programs "already existed." Music at MIT had a distinguished history and a very visible group of students who performed alone and in ensembles throughout the school year. There was a popular undergraduate theater program that included Dramashop and the Shakespeare Ensemble, and modern dance classes were taught by one of New England's most respected choreographers. Visual arts classes were taught in the Architecture Department, but Joskow found that, in the years since the visual arts were headed by Gyorgy Kepes and Minor White, this program had been seriously eroded. Classes in the history and theory of art and in writing filled out the undergraduate offerings. Each year, it seemed, enterprising students might create interdisciplinary concentrations with an arts component, but these were rarely recognized or used to nurture bonds among the arts enclaves.

The campus arts community is optimistic that Harris, with her administrative charter and professional insight into the lives and concerns of working artists, can harness their scattered energies, temper the inevitable clashes over differing artistic philosophies and priorities, and weld conflicting demands on scarce space and funding

into a persuasive argument for more of both.

In her first months on the job, changes were already underway. With the shift of a preposition, the 15-year-old Council on the Arts became the Council for the Arts, its shape as a quasi-independent arts foundation remodeled so that it more resembled a board of trustees. This step also clarified the distinction between fund-raising and the creation of arts policy. At the same time, MIT established an administrative Creative Arts Council (comparable to the existing Engineering and Science Councils) that brings together the deans of relevant schools and chairs of major arts programs.

Pre-Joskow Report, there were four subjects offered in theater arts; post-Joskow there are 12. Dance added lab options; offerings in music continue to climb; and four subjects were introduced in the new Visual Arts Program.

When the administrative kinks are ironed out and new programs are in place, however, an ambivalence over the role of the arts within the MIT community will persist. To illuminate that discussion, the *Review* sought out individuals known for their strong, often provocative, opinions about the arts and their ability to analyze the issues at hand.

These interviews took place over a four-month period, and although

DEBRA CASH is a freelance arts writer in the Boston area.

there was no consensus, each person addressed the issues with passion and seriousness. Each commentator was mindful that the position of the arts at MIT signals, at least in part, how the arts are perceived within the context of technological pursuits.

Taking the arts seriously invariably raises questions about their value and a debate over what the arts are for. Until recently, the "well-rounded engineer" who appreciated the arts was not very different from the "well-rounded person" turned out by the liberal arts colleges. MIT graduates, with their powerful, salable skills, were expected to rise to prominence in business and industry. Many would wind up on the boards of symphonies and art museums, and an education that prepared them for that role was deemed appropriate even at an institution dedicated to useful technology.

That tradition has been supplanted with a new ideal, one reflected in the Joskow Report's deepest premises. This model postulates that the arts offer alternative ways of thinking, extra tools for an engineer's intellectual arsenal.

"If you're an engineer, the more ways you have in your head for thinking about things, the more you'll be able to do, because you'll have many different views," says President Emeritus Jerome Wiesner, whose own experience and enthusiasm for the arts has exemplified and been the driving force behind the artistic presence on campus for decades. He's echoed by Associate Provost for Educational Policy and Programs Jay Keyser, who argues that artistic projects are essentially problem-solving activities. Whether it's Chaucer trying to develop a new kind of ironic narrative or the physicist trying to resolve elemental forces, Keyser maintains, both are involved in the same quest.

Professor of Architecture Edward Levine was hired in direct response to the Joskow Report's call for enhanced visual arts programs. He describes the goal of his curriculum, with its team-built projects and en-

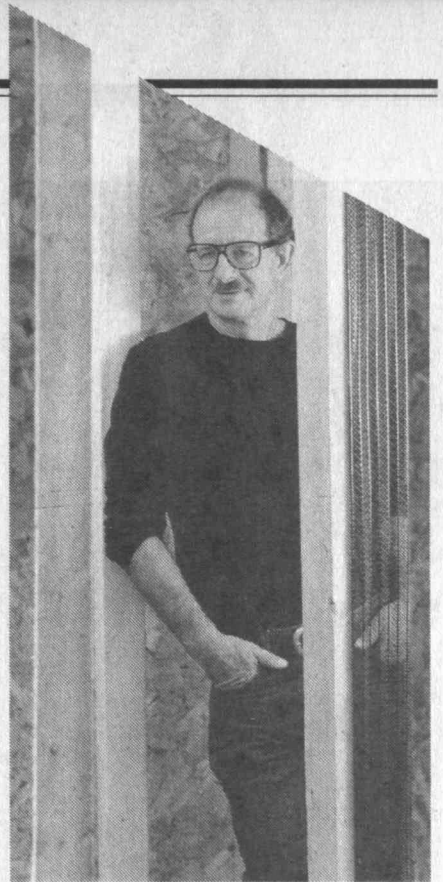
vironmental "performances," as teaching decision-making and risk-taking, rather than creating paintings or sculptures.

Experimental music expert Barry Vercoe of the nascent Music and Cognition Program traces "how a succession of notes chunk into phrases, how a sequence of chords implies harmonic pull, how the parts of a composition make a coherent whole, how musicians operate in skilled collaboration to produce well-rehearsed ensemble music . . ." While in no way conservative in their approaches to the arts they serve, both Levine and Vercoe are playing out a model that supports MIT's technical orientation.

While there are many others who share Wiesner's and Keyser's reading of the value of the arts, that doesn't mean there aren't other views on the table. "My hope is that art programs will play a critical role in both senses of the word, to challenge science education, not just to complement it," says photographer Rick Bolton, who taught at the Media Laboratory and who was brought into the Visual Arts Program by Levine.

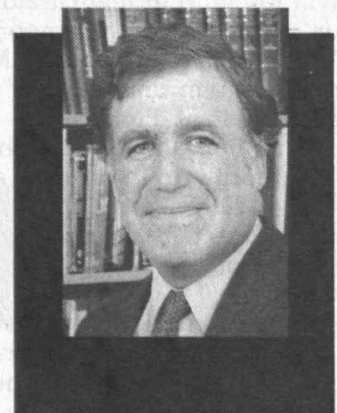
"Science itself constantly violates boundaries and goes outside accepted definitions to look at things in ways that don't fit the [prevailing] paradigm. Any art education will help in that pursuit—the more people appreciate the flexibility of representation and symbol systems, the better they think. But when we ask, 'Can art education make scientists more creative and efficient [and make] the workplace a happier place,' art becomes a kind of tool for fine-tuning the system as it exists," Bolton believes. "I think that what arts can contribute to a technological education is to help identify and critique the status quo."

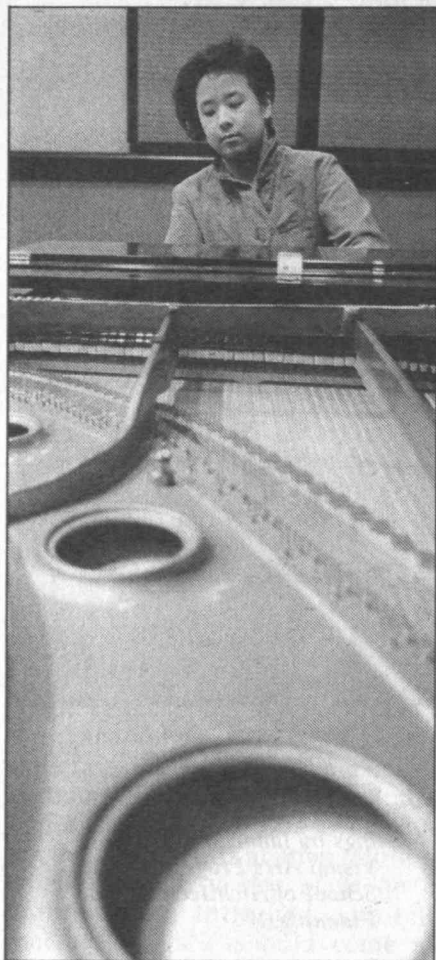
Obviously, there can be as many variations in the ways students receive arts education as there are in the ways the faculty delivers it. Bolton is not the first to find that many MIT students are uncomfortable studying the arts, and he postulates that at least one



Professor Edward Levine came to MIT in the spring of 1989 to help fill a major gap in the arts offerings by launching a new Visual Arts Program in the School of Architecture and Planning.

Mitsui Professor of Economics Paul Joskow was a key player in the recent infusion of energy into the arts at MIT, when he was asked by Provost John Deutch to chair a committee that took a very broad look at the arts on campus.





The latest in the Shakespeare Ensemble's long history of ambitious productions was *King Lear*, with (l. to r.) Bronwyn Barish, G, as the Fool, Charles Roburn, '91, as the Duke of Kent, and Joseph Vanderway, '90, as Lear.

Pianist Jee-Lian Yap, '90 (left), and her twin sister, Jee-Hoon, are among the advanced music students at MIT whose private lessons are supported by a scholarship fund set up by Ragnar Naess, '23. The Juilliard-trained sisters are both majoring in engineering.

of the reasons may be that unlike technical subjects, arts classes do not spell out what will be expected of students. Nor do the arts offer concrete, predictable criteria for success. Music Professor Marcus Thompson has been known to shake his head and sigh that students ask for the rules about art, not realizing that mastering the "rules" will actually limit their reach.

David Joselit, a former curator at Boston's Institute for Contemporary Art, quit his job to enroll in an MIT doctoral program under newly appointed Assistant Professor of Architecture Benjamin Buchloh, a world authority on the history and criticism of 20th-century art. In the undergraduate class he teaches on the history of art, Joselit sees another hurdle for MIT students. "They come here with such weak backgrounds in art; they typically studied very little art in high school. The faculty here is first-rate, so the

students are struggling to acquire a basic knowledge and at the same time keep up with a very sophisticated discussion in class; it's really hard for them to do it all."

And then there is the eternal headache of the MIT student: who has time for anything but problem sets? Although some deny its importance, "nerd machismo" does exist, and many students take a certain pride in "grinding themselves down" with work. In these quarters, the arts are perceived as a distraction from the real work of becoming the best engineer or scientist one can be, and students who devote themselves to artistic pursuits risk being perceived as "soft-headed," not "tough enough to take it," or, as one faculty member suggested, "a dilettante."

Those who bring well-developed artistic talents with them when they register as freshmen sometimes have it easier. Scholarships for high-

quality private music lessons for credit, for example, awarded by audition and established with funds from outside the Music Section's regular budget, have expanded dramatically since last year.

But for students without previous arts interests, the mission is less clear. "Why should a hotshot computer expert be interested in 'Tristan and Isolde'?" composer John Harbison asks rhetorically. Harbison is the Class of '49 Professor of Music and Theater Arts. "'Tristan' is a huge temporal obstruction, a five-hour ordeal," he says. "Even in Wagner's time, it was a lot to ask of people. And Tristan, that poor loser, thinks about his past. He won't give an MIT student any marketable skills."

As if there weren't enough obstacles in their paths, the Joskow Report confirmed that students were regularly turned away from enrolling in subjects that were supposed to engage them with the arts in the first place, including writing—which everyone agrees is critical—and the popular introductory architecture subjects. The size of programs in filmmaking and photography declined throughout the 1980s, despite demonstrable student demand, and are only now beginning to reemerge. While it's a good sign when students are clamoring for these subjects, citing the numbers turned away is hardly something to be proud of.

"Students receive mixed messages," says Mark Palmgren, who has gained a wide overview of developments in the arts, first as program officer for the Council on the Arts, and now as director of programs for the revamped Council for the Arts. Like many others, he notes that many arts subjects are relegated to the independent activities period (IAP) in January. While some students and faculty, including Ellen Harris, call IAP a time for exploration, others—both faculty and students—view it as a "vacation," a waste of time that could have been devoted to "real work."

While the arts programs have brought highly respected musicians, visual artists, and filmmakers

to campus, Palmgren makes a good point when he says that "things are done in the name of students, but [the students are] not full participants." Certain clear student interests have not been reflected strongly in MIT arts programming, he says, especially jazz and world music, which might find a natural audience in MIT's multinational, multiracial community.

As the arts gain more visibility, the search for new educational models and formats for subjects that fit the unique perspective of the MIT student can be expected to intensify. The DramaShop concept offers theater study within the structure of a laboratory paradigm, with the students going from casting to performance of one-act plays in quick, highly supervised cycles. The visual arts faculty has assigned team projects where students collaborate on building large-scale artifacts—a strategy that reinforces the recent value placed on team efforts in the School of Engineering.

And Harris, who has met and made initial alliances with a number of arts presenters and curators in the Boston area, hopes to enhance a flexible program of artists' on-campus residencies, possibly in cooperation with local museums, galleries, and concert presenters.

The irony, say a number of arts observers, is that despite the fact that MIT humanities concentrators often feel like second-class citizens, arts education available at MIT now may be as good as that at many liberal arts colleges where the arts are a much higher priority. Many arts classes are limited to 20 students, and Joselit, whose undergraduate degree is from Harvard, was surprised and impressed at the caliber of faculty teaching even the introductory subjects.

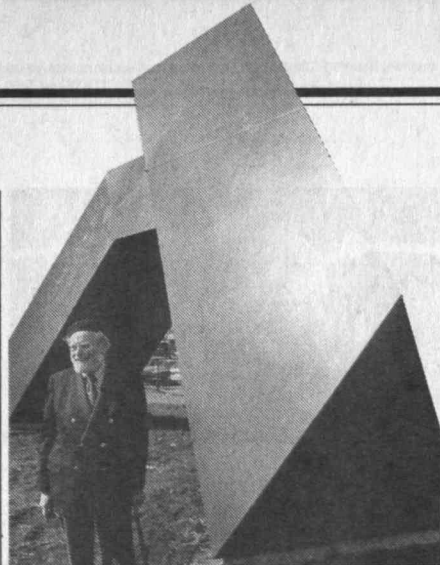
But whether the arts flourish or wither at MIT depends on more than curricular innovation and openness. It depends on money. "Creative arts programs cannot be built around the traditional research model, in which the engine of new academic programs is research funding, and where the faculty de-

pends on research funds for a large fraction of its support," the Joskow Report observed.

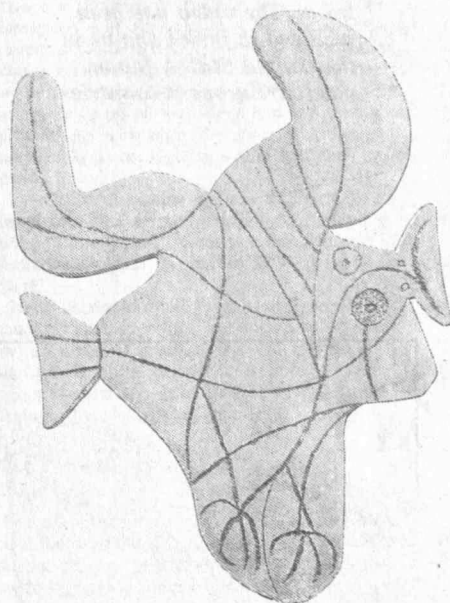
The money issue comes quickly to the fore when attention moves to MIT's facilities for the arts. The adjectives one hears range from "barely adequate" on to "embarrassing" and "appalling." One person described the spaces for music, theater, and dance as rooms and offices "more suited to a fourth-rate high school than a major university." Theater sets and costumes are warehoused in makeshift accommodations. Kresge Auditorium, built as a convention center rather than as a performance space, has terrible acoustics and no wing space. Until this year, choreographer and dance teacher Beth Soll was often seen swathed in layers of shawls and legwarmers, holding conferences with her students in the hall outside the makeshift dance studio in the du Pont Athletic Center.

Part of the problem, says David Lundberg, the director of development for the School of Humanities and Social Science, is that "People understand that scientists need laboratories to express and develop their creativity. They don't appreciate that the same is true for the artists, who need practice rooms with soundproofing, rehearsal space with a sprung floor, studio space with natural light and proper venting." Architecture Professor Leon Grossier argues that the lack of appropriate space is the single greatest obstacle to offering more arts classes for more students.

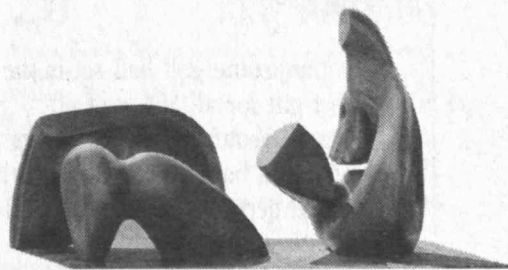
A performing arts center is on the wish list of everyone connected with the arts at MIT, but not even Harris thinks this big-ticket item will come into being soon. Raising money for such a building will be complicated by the fact that the Wiesner Building was originally conceived to serve some music and performance needs as well as other arts and media technology programs, and the view is still held in many quarters of the Institute that the Wiesner Building is a "building for the arts." A shift in focus occurred, however, when a \$3 million gift made it possible to create



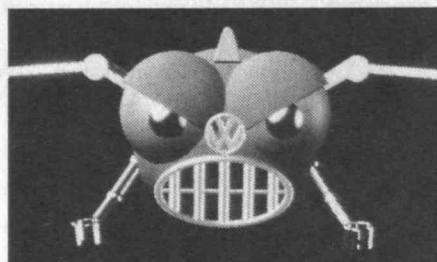
Sculptor Tony Smith
with his massive sculpture,
For Marjorie, near Tang Hall.



Picasso's Figure decoupée
is noteworthy for
—among other things—the
innovative technology it em-
bodies. Based on a work first
done in oil on wood, this
sculpture has a cast concrete
face, sandblasted to show
dark areas of the aggregate
(crushed stone) interior.



**Henry Moore's Three-
Piece Reclining figure,**
Draped, in Killian Court.



Bob Sabiston, '89, now a graduate student in media arts and sciences at MIT, was only a junior when he produced the prize-winning animated video, *Beat Dedication*, from which this slide was taken. The video has been included in juried shows in the United States, Japan, and four European countries.

the List Visual Arts Center—superb space for exhibitions only—and it was decided that the Media Lab would occupy the rest of the building. While the Wiesner Building does include the Bartos Theater for presenting the work of film students and “The Cube,” a high-tech space for electronic music and other experimental media events, it is not primarily a facility where undergraduates and graduate students engage in artistic activities.

There are other interesting and perhaps intractable demographic issues in arts fund-raising. In the experience of development director Lundberg, the arts are not high on the philanthropic priority lists of the group of major donors who graduated from MIT before or just after the Second World War.

Any institution expresses its priorities in terms of how it allocates resources. MIT makes a statement when the *Campaign for the Future* omits the performing arts center as

a goal. Campaign goals do include support for endowed chairs in the arts, fellowships, the artists-in-residence program, the visual arts collection, and classroom renovation.

“I don’t know what’s going to happen down the road when I begin trying to implement [new] programs,” Ellen Harris admits. “There may be some resistance to dedicating Institute funds to artistic ventures.” Harris takes pains to point out that creating and funding her own position was certainly a statement of increased commitment, but she also grins when she adds, “I haven’t been here long enough to suffer.”

Still, Harris believes that the challenge for the arts is clear. “You can’t have first-rate science [and technology] and second-rate art. Second-rate art will allow those who disparage the arts at MIT to argue their case more forcefully. We shouldn’t ask students to swallow that, and the arts deserve better.” □

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CLASS NOTES

15 75th Reunion

Something special has to be said in this issue for the Class Supreme who are celebrating their 75th year since graduation from MIT! It is absolutely fantastic that there are still contributions coming in from this gang for the Alumni Fund. As I have repeatedly said, the loyalty to this great Institute is beyond belief!

I have talked to **Robert Warren** a few times in recent months, and he is spending the winter in Florida and planning on returning to good old New England in the spring. If any of you can make Technology Day this June, I will make it a point to fly down to Boston and join you in the festivities. It would be wonderful to have representation from 1915! In any event, sincere congratulations to each '15er on this great occasion!

You perhaps recall that **Loring Hall** kept a diary during his years at MIT, and I have previously included some of his notes in our column. It seems most fitting to now include the following from Loring's diary during this 75th year:

June 4, 1915: Senior picnic at Riverside, 150 there. It was a complete success and cost within \$10 of my estimate. Course II won the baseball game over Course I, a great tragedy. There was plenty of beer on tap, but no one showed the effects. Made sure of my \$1,400 for Senior Week budget and felt a sigh of relief.

June 5, 1915: Played tennis, got a haircut (25 cents), and then went to the Lenox Hotel to see that our Senior Dinner got off to a good start. There were 193 on hand for it. Expenses exceeded the budget by \$12, mainly due to the musicians, who charged us \$15. Walked up Huntington Ave. with **Millard Pinkham** to the circus grounds and watched as the big tent was taken down, a well organized performance. Can hardly realize there are no lessons to prepare for next week. Wheel!

June 6, 1915: Baccalaureate sermon at Trinity Church. About 200 of the seniors attended, along with their families. Met **Herb Whitcomb's** girl for the first time. Dr. Mann delivered a very good sermon.

June 7, 1915: Class Day and Senior Prom. After the Class Day exercises, I went with **Seward Highley** and **Marshall Dalton** to Reservoir St. in Cambridge, where Elizabeth Eliot's parents gave her an elaborate coming out party. She looked very demure as she stood on the lawn with a big bunch of flowers on her arm. She is a granddaughter of Harvard's president, Eliot, and is smart as well as pretty. It was my first contact with "Society" and I liked it. Came home and got rigged out for the Senior Prom. Mother went with me, also Mrs. Jacobs, who provided a limousine to take us in style to the Somerset hotel. I didn't take a girl because I had too many duties to take care of but enjoyed being a "free lance." It was a grand affair. Came home at about 2:30 a.m.

June 8, 1915: Graduation! At last my first ambition is realized, and I am entitled to a S.B. degree. The exercises were simple and impres-

sive. Extracts from 12 theses were read, and 326 sheepskins were handed out. That was all, except for the good fellowship that we all felt for each other as we exchanged congratulations. Such occasions come but once in a lifetime. After supper, I went back in to Symphony Hall for the "1915 Pops." Besides the traditional concert, with the audience seated at small tables, we put on a series of playlets called "The Presidential Range." Each one depicted the personality and times of one of MIT's presidents. In my skit, which I had rehearsed several times, I was President Pritchett. The series went off smoothly and registered what the boys said was a hit. So ends the wonderful Graduation Week. Now we can go out into the real world and put into practice our four years of scientific training.

Hope these notes by Loring bring back memories! I realize that the age range for you classmates is 96-97, and that alone is an accomplishment, as well as being college graduates "way back when," and making such achievements through your lives!

Have had tidings that **Frank Hull** passed away as well as **Andrew Wardle**. . . Have also had tidings that **Amy Stearns**, widow of **Edmund Stearns**, passed away recently. She was a very loyal person to 1915 and MIT and attended the 70th reunion with **Bob Warren** and myself, and we were both entertained at **Bob Warren's** summer home the rest of the weekend.

I have said it many times, but—my life has been greatly enriched by my association with 1915, for which I am most grateful! Please keep in touch, and if it is at all possible, let me or MIT know if you will be able to attend Technology Day June 8! My love to each and every classmate.—**Joyce E. Brado**, acting secretary, 491 Davison Rd., Apt. 7, Lockport, NY 14094

16

Bruce Crowell writes about his father, **George Crowell**: "Dad celebrated his 96th birthday yesterday. His health continues good except for his eyesight. He is still at West Arms Nursing Home in Brockton. If you are ever up this way, I am sure he would like to see you." Thanks, Bruce. When I am next in the area, I will try to visit him.

As part of the 75th anniversary of the founding of Kiwanis International, the Brockton (Mass.) Kiwanis Club honored George, its last living charter member. In a tribute to George, Attorney **George L. Wainwright** wrote an ode based on the Christmas Carol, "The First Noel." The song was sung by the entire group, and a framed copy of the song was presented to George, who responded by telling the group stories about the early days of Kiwanis in Brockton.

One of our classmates is trying to locate a book, *The Combined Gospels of Matthew, Mark, Luke, and John* by **Russell Hubbard "Rusty" White**, published by Colonial Press, Clinton, Mass., in 1947. Contact me at the address below if you can help me acquire a copy of this book.—**Bob O'Brien**, acting secretary, 25 Keith Rd., Pocasset, MA 02559

17

Please send news to your class secretary.—**Don Severance**, '38, acting secretary, 39 Hampshire Rd., Wellesley, MA 02181

18

We are at the time of the year when news of classmates is at a minimum. I am happy to report a most welcome greeting from **Giles Hulseman**, who is wintering in Tucson, Ariz.: "I am glad to see you are evidently in good health and spirits. So am I; am off all medicines and am getting my old strength back again. I hope you outlive me, but it looks to me right now you will have to go some."

I am grateful to Mrs. **Richard Rimbach, Jr.** for (upon receiving my well wishes) the following news: "I'm sorry to inform you that Mr. and Mrs. **Richard Rimbach, Sr.** died in 1979—three weeks apart."

Herb Lerner, only 97 years of age, sends his usual cheerful greetings. He and **Realia (Wellesley)** have been corresponding with the *Review* about their strong conviction to uphold women's rights to abortion.—**Max Seltzer**, secretary, 865 Central Ave., Needham, MA 02192

19

Your class secretary hopes his classmates will excuse the handling of our class notes in the *Review* during the past year or more. Eye surgery has made it possible for me to read and write again, so I now expect to have regular columns again.

I want to thank all of you who helped put across our 70th reunion, particularly **George Michelson**, **Don Way**, **Edmund Flynn** and **Douglas Burckett**.

Francis Weiskittel writes, "All is well in my 91st year (except for gradual disabilities), and I'm staying home nowadays and taking it easy." We thank Francis for his note and would like to hear from other readers. I am glad to be secretary of such a nice class.—**Bill Langille**, secretary, P.O. Box 144, Gladstone, NJ 07934

20

70th Reunion

Please send news to your class secretary.—**Harold Bugbee**, secretary, 313 Country Club Heights, Woburn, MA 01890

21

Today, February 12, as these notes are being written, is class president **Carole A. "Cac" Clarke's** 90th birthday. Welcome to the ranks. Cac tells me the **Brielle, N. J.**, newspaper, for which he has written a column for many years, has been sold and he is no longer a contributor. Cac was class secretary for 50 years and never missed an

issue—a wonderful record! He recently had a nice letter from Emma Lloyd.

There is one death to report this month, that of **Philip H. Hatch** of Erie, Pa., on December 2, 1989. Phil was a pioneer in the application of the diesel electric locomotive to American railroad service and an authority on railroad electrification. He worked for General Electric, the Cleveland Union Terminals, the New York, New Haven, and Hartford Railroad, and the Long Island Railroad. After retirement, he was a consultant for railroads in Brazil. He wrote several books on diesel and electric locomotives. Our sympathy is extended to his wife, Evelyn, and three daughters.—**Summer Hayward**, secretary, Wellspring House E64, Washington Ave. Ext., Albany, NY 12203; **Samuel E. Lunden**, assistant secretary, 6205 Via Colinita, Rancho Palos Verdes, CA 90274

22

Ray C. Ellis, a former vice-president of the Raytheon Co., has made 18 trips to the USSR over the past 40 years to negotiate various matters for our government. He still keeps his hand in by working on US/USSR exchange programs. A recent letter by Ray published in the *Sarasota Herald Tribune* last February 2 comments on the favorable changing Russian situation. He concludes with a warning: "Our policies toward the Soviets for the next few years should be based on a determination to act firmly but not to precipitate a serious conflict that might 'back the bear into a corner' and solidify anti-American attitudes. The Soviets fear our countries financial and productive power more perhaps than our missiles, and we should give special attention to strengthening all of these capabilities." Ray and Mrs. Ellis (Aline) will return to their home in Islesboro, Maine, in May after their customary winter in Florida.

Martha Eiseman Munzer, whose 10th book *Lauderdale-By-the-Sea, A Living History* was published last November, has recently been giving a series of lectures based on her personal experiences. On a more professional level, this past winter she addressed the Florida Society of Women Engineers on the subject of engineers and the environment.

Bertha S.W. Dodge, our other prominent author, is continuing her writing and publishing of books, mostly in the general area of economic botany. A phone call to **Bob Tonon's** office not long ago (he was not in) elicited the information that he is in active full charge of his two companies, Peter Gray Corp. and Barbour Stockwell Co. Incidentally, during World War II, your secretary was in-house counsel for Barbour Stockwell. At that time, **Ernest Stockwell** (deceased many years ago) and **Ed Ryer** (still with us) were president and secretary respectively.

I hope there will be a good turnout of '2ers for Technology Day in June.—**Yardley Chittick**, secretary, Rte. 1, Box 390, Ossipee, NH 03864

23

For those of you who are interested in the weather, southern New England witnessed the coldest December on record, temperatures as far down as 10 degrees below zero at one point. High winds several times brought the chill factor to 40-50 below. January made up for it with temperatures reaching over 70 degrees F. These notes are being written in early February.

A telephone call and a follow-up letter were received recently from Charles A. Spiegel, '32. He commented on notes in the *Review* concerning the death of **Philip Schwartz**. As a close friend, he reiterated some of Philip's excellent qualities, including his interest in steering candidates to MIT.

Your secretary is in receipt of two deaths since the last notes were compiled. **Ralph R. Dressel**

died December 1, 1988, in Amity, Oreg. He was married to Virginia M. Burmister of Prescott, Ariz., and they had three children and ten grandchildren. He was active at the Institute in the Civil Engineering Society and in the Benchmark staff. He was a safety engineer in San Francisco and later became an insurance broker.

Brig. Gen. Roland P. Shugg, died in December 1989. He was married to Blanche Page of New York City, and they had four daughters and 12 grandchildren. He served in the U.S. Army during World War I, World War II, and the Korean conflict. He received a number of U.S. and foreign decorations. Roland's field was mechanical engineering, and while at MIT, he was selected for special study in automotive engineering, serving on many boards and staffs charged with revising field manuals and maintenance procedures.

Listen! Your classmates would like to know what you have been up to. I'll tell them, if you will tell me.—**Frederick O.A. Almqvist**, secretary/treasurer, 63 Wells Farm Dr., Wethersfield, CT 06109

24

A letter from **Miguel Amezcaga** tells of the passing of **Prescott H. Littlefield**, '97, on December 21, 1989, in Naples, Fla. He had been ill for some time. Peggy, his wife and a very close friend of Miguel's, wrote a letter to him with this information. Condolences to Peggy and the family.

Miguel writes that he is just 96 and still working as a tax consultant with the Internal Revenue Service in Chevy Chase, Md. Thank you, Miguel, for writing.

A card to me from Mrs. Lola "Jackie" Tryon in Deerfield Beach, Fla., gives us the news about **Joe Tryon**. "Joe Tryon passed away January 9, 1990. He attended the University of Texas and Rice Institute, but MIT was the bright star of his college life. He had ill health for the past few years. He is survived by his daughter, Lynn Early and son, Jon W. Tryon." Our sympathy to all of you.—Co-secretaries: **Katty Hereford**, Hacienda Carmel, No. 237, Box 5397, Carmel, CA 93921; **Col. I. Henry Stern**, 2840 South Ocean, #514, Palm Beach, FL 33480

25

65th Reunion

Sam Spiker, **Courtenay Worthington**, and your secretary met at MIT in mid January, and with the assistance of Christine Foglia made final plans for our 65th reunion. The results of that meeting were reported by Courtenay before he left for a month in Antigua. **Sam Spiker** went south near the end of February, and some classmates may have seen him down there.

The passing of two classmates must be reported. **Leonard Peterson**, '36, provided the information that **Paul Breer** died at the Mount Loretto Nursing Home in Amsterdam, N.Y., on December 8, 1989. Following graduation, Paul was employed as a chemist for A.C. Lawrence in Peabody, Mass. When he moved to Amsterdam, he worked for the former Ritter Chemical Co. for 10 years. Later he went with the Iroquois Chemical Co., became president and owner and operated that company for 30 years until his retirement in 1979. Paul is survived by his wife, Loretta, of 63 years, three sons, a daughter, 11 grandchildren, and five great-grandchildren. . . . **Ralph Gow** of 14 Monmouth Rd., in Worcester, Mass., died January 16, 1990. Ralph worked for the Norton Co. for many years serving as president before his retirement. He is survived by his wife, Eleanore, one son, one daughter, a brother, five grandchildren, and one great-grandchild.—**F. Leroy "Doc" Foster**, secretary, 434 Old Comers Rd., Box 331, North Chatham, MA 02650

26

I have been hoping to hear from one or more of you. . . . My wife, Mary, and her nephew had a surprise party for my 85th birthday last July. It was terrific—two big tents, tables, chairs, four musicians, a caterer, and a photographer, and over 75 friends. We had wonderful weather for the occasion.

Professor **Robert R. Morrissey** of Cape Neddick, Maine, died November 30, 1989, after a long illness. He was a research scientist for the Atomic Energy Commission at Columbia University. Prior to being a professor there, he had been at a number of other universities. He kept active in various scientific organizations and church groups. He leaves his wife, Margaret. . . . **Nathan Pearlstein** of Hartford, Conn., passed away on March 12, 1989. He leaves his daughter, Eleanor, of Newington, Conn.—**Donald S. Cunningham**, secretary, 27 Lowell St., Braintree, MA 02184

27

This past month, our class lost two of its most accomplished and generous classmates. **Frank Massa** died January 2, 1990, in Cohasset, Mass. He was stricken by a heart attack at his office, the Massa Products Corp., in Hingham. He was considered the "father of modern sonar transducer development" according to *Sea Technology* magazine. A letter sent to him by the Secretary of the Navy in 1950 credited him with being personally responsible to a large extent for the Allied victory of World War II because of his development of sonar equipment for the Navy.

He also was a pioneer in the design and manufacture of electroacoustic systems used in sonar and air ultrasonic applications. Although Frank started his first year of grade school unable to speak English, his writing eventually appeared in four textbooks and in many articles for technical journals.

Frank's career started at the Victor Talking Machine Co., where he helped develop loud speakers, microphones, phonograph pick-ups, and test equipment. At the beginning of World War II he was director of acoustic engineering at Brush Development Co. in Ohio and designed underwater equipment used in mines, torpedoes, sonar, and hydrophones. He joined with a former associate at Victor to cut government red tape to get new gear in production and make the first successful scanning sonar to put in service in the war effort.

The use of ultrasonics in medicine was forecast by him in 1950 when he envisioned its use in the treatment of arthritis and cancer. He established a fund at MIT to explore these uses. He worked with MIT, University of Hawaii, and the *National Geographic* to develop ways to track whales. Frank wrote an article in last November's *Sea Technology* for the restoration of teaching production engineering and design in technical schools. Present product design and production programs do not work.

Frank remained active as chairman of his company, founded in 1950, until his death. He received 130 patents for his inventions and was a member of the American Institute of Physics and life fellow of the Institute of Electrical Engineers. . . . We send our sympathy to his family.

Harold E. Edgerton died January 4, 1990, after a heart attack at the Faculty Club in Cambridge. (See *Technology Review*, April 1990, p. MIT 9.) Throughout a career that spanned over half a century, he was simply "Doc" to hundreds of students, faculty, and staff at MIT. He was celebrated for the warmth and concern he displayed for his fellow human beings. MIT President Paul Gray, '54, said "He is known to the world as the inventor of high-speed photography and as a major figure in its many applications. He is known to MIT as a teacher of uncommon effectiveness and generosity and as a friend and men-

tor of the thousands of students who had the good fortune to be associated with him during the past 60 years. He has no peers here, and he will be deeply missed."

It is difficult to write of all Doc's accomplishments. He developed strobe-light photography. His famous pictures—humming bird wings, bullets shattering a light bulb and piercing a playing card, a drop of milk in a pool of milk to produce a perfect crown—brought him a reputation for inventiveness. He distributed postcards of these pictures to friends from his pocket and, our class adopted the crown as the emblem for our 60th reunion.

Edgerton formed EG&G Co. in 1947 with Kenneth Gernsmaier, '31, and Herbert Grier, '33. The firm developed flashing lights for airplanes and lighthouses and builds and operates the equipment that fires and measures U.S. nuclear weapons tests. Its high powered strobes were adapted for office copying machines and the printing industry.

A pioneer in deep-sea photography and sonar, Doc designed and developed the cameras and lights used by Jacques Cousteau in his undersea research and films. He often accompanied Cousteau on his expeditions. They began their collaboration in 1952 from a suggestion by the National Geographic Society.

Doc's sonar devices using his side-scanning have made it possible to draw profiles of rock layers far beneath the mud under water and to locate shipwrecks and artifacts under many feet of mud and silt. He believed the regions under the sea are likely to be more important to future generations than regions in outer space. "The sea is here and waiting to be explored."

Doc was a founder of the New England Aquarium and a trustee of the Museum of Science. Among his many honors were the Gold Medal of the National Geographic Society, the Modern Pioneer Award, the Potts Medal and Albert A. Michelson Medal from the Franklin Institute, the Silver Progress Medal of the Royal Photographic Society, the Progress Award of the Society of Motion Picture and Television Engineers; the E.I. DuPont Gold Medal, and the Richardson Medal of the Optical Society of America for "outstanding contributions to the field of high-speed photography."

He was a devoted family man, and we extend our deep sympathy to his wife Esther and to his large family.—**Joseph C. Burley**, secretary, North River Rd., Epping, NH 03042; **Lawrence B. Grew**, assistant secretary, 21 Yowago Ave., Branford, CT 06504

28

Our class has had various notable members brought to our attention from time to time as the result of some outstanding recognition. Such has been the case with **Frank Taylor**. In December of 1988 Frank was notified by the Board of Regents of the Smithsonian Institution that an exhibition gallery in the National Museum of American History would be named the "Frank A. Taylor Exhibition Gallery." This highly distinctive honor was in recognition of Frank's pivotal role in the establishment of the National Museum of History and Technology and his long service, which helped to shape the Smithsonian as it is today. The dedication was held in April when Frank and Mary (Mrs. **Arthur H.**) **Nichols** were both in Washington. The event was followed by a pleasant evening reception attended by more than 200 friends, family, and Smithsonian colleagues. Although this is a very tardy report (blame your secretary), we do congratulate Frank most heartily on this special and well-deserved honor. We understand that Mary now has had two eye lens implants, and both are highly successful. This is great news, and we are most happy for her.

George Mangurian and wife, **Peggy**, have found that moving from a small-town home in Connecticut to an apartment in Washington, D.C., has

required a lot of adjusting. Last August they made their second trip to Italy to visit with their son, who has a graduate architectural school near Rome. . . . A note from **Kanshi Minocha** in Bhopal, India, tells us that he keeps fit at age 88 by taking regular morning walks. He enjoys reading spiritual literature and then discussing the subject matter with a small circle of friends. He also keeps up with professional literature and world events. . . . **Ellen and Larry Glassman** continue to enjoy their travels. Last summer it was a motorcoach tour through the Canadian Rockies. That fall they had a 21-day cruise on the *Vistafjord* to Spain, Morocco, Canary Islands, Senegal, Cape Verde Islands, and Madeira. They continue their volunteer work as museum docents, she at the National Museum of American Art and he at National Air and Space Museum.

We have a gracious note of thanks from **Esther Edgerton** in acknowledgment of a contribution from '28 to the Class of 1927 Harold E. Edgerton Memorial Fund. "Doc" was a well-loved honorary member of '28. With deep regret we must now report four class-related deaths: **Walter E. Norton (Norkevicious)** died September 23, 1989, following a stroke in August from which he never recovered. **Walter** graduated in Course 15, business and engineering administration. For many years, he was an industrial engineer for **Henry Disston & Sons Co., Inc.**, in Philadelphia, then an industrial relations manager when that company became a part of **H.K. Porter Co.** in Philadelphia. **Walter** was very proud of his Lithuanian heritage and of the fact that he became an MIT graduate despite the severe handicap of limited resources during student days. . . . **Kenneth M. Peterson** died of a sudden and massive heart attack on October 30, 1989. **Kenneth** graduated in Course I, civil engineering, and followed that profession as his lifetime career mostly in public water and highway services in California. He had strong interests in music (violin and piano), which apparently were developed rather late in life. Another interest he enjoyed was tutoring in high school level math and science. . . . A note from **Otto B. Wiessner**, '26, has informed us of the death of **Edward J. "Ted" Wood** on January 11, 1990. They were very close friends. **Ted** graduated in Course 15, business and engineering administration. In 1934, he joined **American Airlines, Inc.**, and made the development of that company his lifetime career. **Ted's** wife, **Margaret (Peggy)**, survives him. . . . **Olivia M. Solomons**, widow of our classmate, **Gustave M. Solomons**, died of pneumonia January 8, 1990, while hospitalized. **Olivia** was a graduate of **Boston University** (1930), taught school in **Cambridge and Boston, Mass.**, and was prominent in various church and social activities. **Florence** and your secretary attended her beautiful memorial service. . . . To the families of these classmates we extend our heartfelt sympathy.—**Walter J. Smith**, secretary, 37 Dix St., Winchester, MA 01890; **Ernest H. Knight**, assistant secretary, Raymond, ME 04071

29

Hyman J. Fine of Norfolk, Va., writes, "My recent activities include employment on various engineering projects, tennis, and assisting my wife, **Edith**, in her endeavors on behalf of the World Affairs Council of Greater Hampton. . . . A brief note comes from **Marion and Earle Erickson** of **Burlingame, Calif.**: "Many thanks for the birthday greetings! Time seems to be passing rapidly. We regret that we were unable to attend our 60th reunion, but we are looking forward to our 65th! Best regards to all." . . . **Warren A. Spofford** of **Tyler, Tex.**, sends a note: "I am now 82 years old and fortunately in good health. Three grandchildren got married in the past four months." . . . From **Takanao Kukui** of **Tokyo, Japan**: "I am still working, and my English (which I learned at MIT) is still adequate to do my work after 60 years."

Barbara and George J. Meyers, Jr. sent a year-

end letter: "George gave his talk, "Search for the Future," to the Torch Club and to the Berk's County Amateur Astronomy Club. He presented evidence of extreme planetary influences on earth in the nineties. Attendance at our reunions (MIT and Radcliffe) enabled us to visit the Kingsleys and Ginney Townsend. Returned home to cope with termites that the wet spring had caused to swarm as never before. Exterminators cleared space at all cellar walls. We had three weeks of this, necessitating the aid of all Meyerses within travel range. This had to be done by July 10, before **Barbara** had one total hip replacement." One of the Meyers' sons, **Robert**, who was born in 1945, came up with some interesting observations about his age group: "We are survivors. . . . Consider the changes we have witnessed: We were before television, penicillin, polio shots, frozen foods, Xerox, plastic, contact lenses, frisbees, and the pill. We were before radar, credit cards, split atoms, laser beams, ballpoint pens, pantyhose, dishwashers, clothes dryers, electric blankets, air conditioners, drip dry clothes, and before man walked on the moon. In our time, closets were for clothes, not for "coming out of." Bunnies were small rabbits, and rabbits were not Volkswagens. Designer jeans were scheming girls named Jean, and having a meaningful relationship meant getting along well with our cousins. . . ."

A very interesting letter comes from **Larry Hamlin** of **Boynton Beach, Fla.**: "As for career, mine can be described in one sentence. After graduation, I got a job with an oil company, had an enjoyable 32 years working around the world, was fortunate to become a director, eventually retired, got a plaque (no gold watch), got a pension and came down to sunny Florida where, between hurricanes and assessments, I try to squeeze in a little woeful golf. As for family, I've got a couple of kids and a passel of grandkids, all of whom seem to be doing well." **Richard E. Bolton** of **Canada** writes: "This past Christmas could have been a very lonely one for me, but the children looked after me very well. I have lived alone these last six years, so **Betty's** death was not as severe as it might have been. I am glad the reunion was such as success, and I would very much have liked to be there. But our family in England had to come first, as there are some members I may not see again because of their age. It was like a 'busman's holiday,' in that I did a bit of house designing for a couple of nephews—and, of course, bought a new pair of shoes. Most of last year seems to have been spent in reorganizing my financial affairs so that eventually the children and grandchildren can make use of **Betty's** estate, as I have simple tastes and enough money to satisfy them. Tax departments and trust companies operate rather slowly; like a game of chess, moves have to follow one another in a certain order. Not being trained as an accountant, I have to rely on other clever people who are familiar with tax laws. At present, I have two literary projects to complete. One is finishing the family history, including some frustrating genealogical research into our relationship with **Alexander Hamilton**. Some of my American ancestors were on the other side of the Revolution and were given a very hard time by those who proclaimed 'The Land of the Free.' And the other project involves helping to write some chapters on the civil engineering branch of the **Royal Canadian Navy** during the **World War II** period. Of all the officers involved during those years, only two survive, and I am one of them. The book will be the official history of military engineering in Canada from 1756, in three volumes."

I regret to announce the passing of the following members of our class: **Robert K. Miller** of **Al-lentown, Pa.**, September 4, 1989; **Edward E. Reigle** of **Midland, Tex.**, September 21, 1989; **Mrs. Frances M. Hendershot**, **Whiting, Ga.**, November 14, 1989; **Erling S. Mathiessen** of **Milwaukee, Wis.**, November 22, 1989; **Frederic A. Celler** of **Maitland, Fla.**, December 8, 1989; and **Putnam Cilley** of **Sharon, Mass.**, January 2, 1989.



I Remember . . .

... Attending the civil engineering surveying camp at East Machias, Maine, where we practiced laying out a section of railroad. Unfortunately, right after I graduated, they quit laying out railroads when something called the aeroplane came along.

... Designing complicated riveted joints in Spofford's class on structures. Unfortunately, right after I graduated, they quit designing complicated riveted joints when something called welding came along.

... Working on *The Tech* with Hunter Rouse. What a great person to be associated with! And going with Hunter to Lobdell's office to be "reminded" of our "responsibilities."

... Counting the spokes in the Massachusetts Avenue Bridge as part of fraternity initiation. Does anyone remember how many there are? I have a vague recollection it's an odd number.

... Watching the famous traffic cop at the corner of Massachusetts Avenue and Beacon Street do his ballet version of traffic control. What a shame traffic lights had to be invented.

... Sitting in the balcony at that little playhouse on Boylston Street watching the cast do an Agatha Christie mystery. How much did it cost? Seventy-five cents?

... Envy my more affluent fraternity brothers as they played the stock market during our senior year and gloated about their expertise. Somehow I don't think I missed much on that score!

... Going on the Senior Picnic on some sort of barge to some sort of island to engage in some sort of shenanigans. Funny how that episode seems so hazy.

—Larry Hamlin, '29

Robert K. Miller joined the Park & Shop staff in 1956 as property manager and subsequently rose through the ranks to become the company's executive director. During World War II, he was an engineer with Day & Zimmermann of Philadelphia. In April 1984, he redesigned the carillon in the David A. Miller Tower at Muhlenberg College. . . . Frances M. Hendershot was a summer resident of Westport Point all her life. She was a graduate of Bradford Junior College and took graduate studies in biology at Boston University and MIT. . . . Frederic A. Celler was active in class and in the Franco-American Association of France, fostering good relationships between these two traditionally friendly nations. Some years ago, he established residence in Florida for the winter months with his wife, Margory, and went back to France for the rest of the time. Prior to our 60th reunion last June, he sent me a note stating that his health did not permit him to attend.

I had a close relationship with Putnam Cilley, which makes his passing the end of an era. For more than a decade, Putnam, the late Arthur Bearse, and I attended Alumni Day (now Technology Day) exercises every June. We never missed a reunion. Put and Arthur had known each other since high school days, and when I became class secretary 20 years ago, I got to know them better by association. Just before Arthur passed away in February 1987, Put informed me that Arthur was too ill to attend. He attended his last reunion in 1986 accompanied by his wife, Claire Elizabeth. Putnam's wife sent me a note in January: "I am sorry to have to tell you that my husband, Putnam Cilley, died on January 2. He just loved to attend his class reunions at MIT." It would be an understatement to say that I was shocked and dismayed on the news of Put's passing.—Karnig S. Dinjian, secretary, P.O. Box 83, Arlington, MA 02174

30 60th Reunion

These notes, prepared in early February, are the last you will receive before our 60th reunion. I understand from Yicka that the final reunion letter, including registration material, will soon be in the mail. This month's mail indicates that probable attendees will include Grace and Al Burling, Doris and Les Engler, Mildred and Ed Giroux, Margaret and Morris Shaffer, and maybe Mary and Win Hartford.

For a longtime class secretary, one of the most rewarding events is communication from a classmate not previously heard from. This month's "first-time communicator" is Mary Elizabeth (Polly) Betts Elderfield. As many of you know, Polly married fellow-chemist Bob Elderfield, who received a PhD from MIT in 1930. Bob died about 10 years ago, and had been a professor of chemistry at the University of Michigan for many years. During his professorship, the Elderfields collaborated in editing a six-volume series on heterocyclic chemistry. Polly still lives in Ann Arbor, Mich., and has two daughters, six grandchildren, and one great-grandchild. At the time of writing, she had just returned from a cruise down the west coast of South America and around to Buenos Aires with a granddaughter who had been invited to attend a professional meeting in Buenos Aires.

Doris and Les Engler still shuttle between Quechee, Vt., and Ft. Lauderdale, Fla. Les does volunteer work at Mary Hitchcock Hospital in Hanover, N.H., during the summer and at Holy Cross Hospital in Ft. Lauderdale during the winter. . . . Grace and Al Burling live in W. Barnstable, Mass. They are members of both the Cape Cod MIT Club and the Cardinal & Gray Society, which meets at MIT's Endicott House in Dedham several times a year. Al reports that these meetings "provide pleasant surroundings, good food, congeniality, and interesting, currently knowledgeable speakers and personnel from MIT."

Angelo Ricciardelli lists as his retirement activities studying Italian literature at the University of Virginia, recording for the blind, and jogging every morning. He and his wife are planning trips to Hawaii and western Europe this year. . . . Correction: Reg Bisson is not "sole owner of a construction company in Laconia, N.H." as stated in the January notes; he discontinued the business in 1976 when he retired.

This month notices came in concerning the deaths of two more classmates: Robert Lent last August 12, and William Locklin November 21. As of 1983, Bob Lent was still practicing architecture in Houston, Tex., working mostly on the design of large houses for his clients. In 1987 he reported that he was "almost retired—but enjoying painting water colors at the moment." My records indicate that he is not survived by any close relatives.

Bill Locklin's death was reported by Wyman Boynton, '31, who together with Bill and our classmate Jack Vennard graduated from Portsmouth, N.H., High School in 1926 and entered MIT that fall. (Wyman had to drop back a year because of health problems.) Bill worked for New York Telephone Co. in Albany for many years as a project engineer, largely on the development of new tools, materials, and methods for outside construction work in upper New York State. During World War II he served as a lieutenant colonel in the Army Corps of Engineers, and on one of his tours was with a unit working on the service road for the Alcan Highway. He retired in 1969 and thereafter did volunteer work. In 1978 he reported having devoted 400 hours to the patient-transportation driving for the Red Cross. Bill's longtime home was in Guilderland, N.Y. His first wife Blanche died in 1979 and he remarried in 1981. His second wife, Helen Janss Locklin, survives him. My records indicate that he had no children.—Gordon K. Lister, secretary, 294-B Heritage Village, Southbury, CT 06488

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The comment that I had heard little from you provoked a number of interesting notes. One was an article from the *Sunday Star Ledger* sent by Ad-dis "Ad" Kocher, who resides in Boonton, N.J., telling of some of the interesting occurrences during his more than 40 years with Bendix Aviation. Ad was quite proud of his dad, who was also an engineer and worked for Thomas Edison at one time. He later had his own business and acquired more than 40 patents. Ad seemed to have an affinity for pilots who made early airplane history. He checked out the electrical system in Wrong Way Corrigan's 1929 Curtiss Robin before the flight that earned him his nickname. When Ad finished checking things out, Corrigan said, "Mr. Kocher, if I make this flight that I'm planning, I'm going to make you famous," to which Ad replied, "Maybe I don't want to be famous." Some of you may remember Corrigan took off from New York claiming he was flying to California but landed in Ireland after he was unable to get approval to cross the ocean in his flying flivver.

In 1942, Kocher was at a meeting of the Institute of Avionautical Service where Jimmy Doolittle was the guest of honor. That evening Jimmy's wife told Ad that Jimmy had gone to Wright Patterson Air Force Base but she didn't know why. According to Ad, Jimmy went to pick up his orders to bomb Tokyo. Ad was hired by Bendix in 1931 and retired in 1972 as research director. During those years, he was in charge of building the first 25 autopilots for both the DC10 and 747 as well as the first autopilot for the supersonic B58 Hustler bomber. Ad also had a lot of stories about other notable aviators, which I will pass on later.

Ben Steverman writes to say the article on Gil Ayres recalled memories of their days at Brookline High School. He also asks about 80th birthdays and 50th wedding anniversaries. This hits hard, as I've had my 81st and on February 1, my

55th. How about it fellows? Ben says that age has caught up with him so that he no longer makes pilgrimages from Plymouth to Friday afternoon symphony concerts where he used to see Charlotte and Ed Hubbard. Ben also says that our class treasury is in pretty good shape with about \$2,000, which he says will give Dick Ashenden and Johnny Swanton a kitty to work with to get next year's 60th "show on the road."

A note from Helen says that Ed (Worden) is improving and can now play cribbage. Wish he lived closer—I'd like to see if he is as good as I used to be after my grandfather's tutoring.

Have been having a lot of fun with a few alumni who don't seem to know what class they belong to. Had a very nice note from one, but the directory had a different year for him. So I wrote and asked what class was correct and got a lovely note back indicating that after he had looked over all his diplomas (he had a number) he found he did not graduate with us. But he was at MIT in another class and knew Professor Babcock, who was admired by all of us.—Wyman P. Boynton, secretary, 668 Middle St., Portsmouth, NH 03801

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Our president, John Brown, informs me that plans are under way for our 58th mini-reunion in Cambridge on June 7-9, 1990. We will coordinate our plans with the MIT Cardinal and Grey Society during the Technology Day celebration. The Cardinal and Grey Society, composed of MIT alumni/ae who graduated 50 or more years ago, has been active in the Cambridge area for over five years. We will have accommodations at McCormick Hall, similar to our 50th and 55th reunions. On Thursday, a special dinner will be served at McCormick before we take a bus to Pops at Symphony Hall. On Friday, Technology Day, there will be some stimulating lectures in the morning followed by a luncheon where our class will sit together at special tables. An interesting program is being developed for the remainder of the reunion. By the time you read this, you should have received complete information in the mail. Hope to see you at our mini-reunion in June.

Evelyn and Eric Newman have always sought adventure and excitement. On their honeymoon 50 years ago, they were in Montevideo Harbor and witnessed the scuttling of the German pocket battleship, *Graf Spee*. They recently celebrated their 50th wedding anniversary by going to Vietnam and Kampuchea. Eric writes: "My wife and I enjoy supporting the laboratory in the Mechanical Engineering Department of MIT, where Professor Robert Mann and his group have continued to undertake research in human rehabilitation. The cooperation of undergraduates, graduate students, and faculty, along with many in other institutions, makes this laboratory the ideal setting in which research can make wonderful progress. The third edition of one of my books on numismatics will be published this month, and I continue to write up the results of my numismatic research. I operate a coin and currency museum in St. Louis, which is open to the public, and that gives me a way to use my numismatic collection for education and entertainment of others. My wife is the executive director of the not-for-profit organization that runs our large public park in St. Louis, in partnership with the city. My daughter is the co-mistress of a private girls school in New York, and my son is chairman of a large chain of retail stores. My son, my son-in-law, my brother-in-law, a grandson, a nephew, and a handful of cousins are all graduates of Harvard, and I have had to live with this as best I can."

Bob Follansbee writes from Venice, Fla.: "Sue and I are now 'skimmers,' skimming off the best that S. Portland, Maine, has to offer in the summer and Venice, Fla., in the winter. We particularly enjoy the monthly meetings of the very lively MIT Club of Southwest Florida, which counts among its enrolled members the following

1932 classmates: Kipling Adams, Manson Benedict, Phil Benjamin, Albert Daytz, Jack Millman, Henry Mitchell, Alfred Mulliken, Robert Crane, and one of our four gal members, Kay (Sarabia) Burrows. Somehow Sam Burrows, '31, bested the rest of us in getting Kay!

Mrs. Don Corson sends us the following sad news: "Don E. Corson of Leicester, N. C., died of a heart attack on December 27; he was 81. An electrical engineer, in 1942 he left his position as sales manager for Aerovox Corp. to found his own company, Corson Electric Manufacturing Corp. The company manufactured high-voltage capacitors, pulse-forming networks, and other high-voltage components. In 1974, he moved to North Carolina, but continued working as a consultant in the high voltage field until the time of his death. He was a life member of IEEE and a member of the Dielectrics Committee."

Charles Spiegel is very active in the education field. He is asking any of his classmates that would like to help edit new editions of math/science textbooks (introductory grades 7-14) to call him at (213) 378-3748. . . . Because of his assistance to the Finn Ronne Antarctic Expedition, the Defense Mapping Agency named one of the mountains in Antarctica Mt. Glowa for Latimer W. Glowa. Hope to see you all in June.—Melvin Castleman, secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

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Please send news to your class secretary.—William B. Klee, secretary, P.O. Box 7725, Hilton Head Island, SC 29938, (803) 785-7746

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Please send news to your class secretary.—Robert M. Franklin, secretary, P.O. Box 1147, Brewster, MA 02631; George G. Bull, assistant secretary, 4601 N. Park Ave., Chevy Chase, MD 20815

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55th Reunion

Early last year, Stocky Stockmayer went to Switzerland for a couple of weeks of climbing in the Alps with friends. Sylvia joined him and they went to the USSR for two weeks, visiting Moscow, Leningrad, and Tallinn, Estonia. In each of the places Stocky lectured "once or more," then went on to Helsinki, Stockholm, and home. He commented, "The Estonia visit was naturally the most exciting, with strong movements for a lot of autonomy in all segments of the population." At a meeting in Holland last April, Stocky joined with two chemists from Austria, a West German, and another American to play the Borodin Quintet (piano and strings). "Borodin was a chemistry professor and composed as an amateur; although his chemistry was first-rate, he's better known today for his music." Stocky will be on the 55th reunion crew Thursday morning, June 7.

James Libby writes from Hockessin, Del., "On June 3, 1989, Helen and I celebrated our 50th wedding anniversary. The Dauphines and Kimballs were there (Thonet and Henry had ushered for me). On October 21 the Kimballs celebrated their 50th and I represented the original wedding attendants. It will be hard to resist our 55th reunion since both are on the committee. If sailing were offered as an activity at the Wianno Club, attendance would also be difficult to resist."

Arthur H. Cohen reports that he is managing the family industrial park in Woburn, Mass., in between visiting their three children and two grandchildren in Portland, Oreg., and two more in Short Hills, N.J., and New York City. Arthur is active in adult education at their temple. . . . Alfred Johnson wrote from Naples, Fla., that he had received a Christmas card from Margaret Scowcroft with this note: "Thought you might

like to know that Gordon passed away October 15. He had a short illness, which is something to be grateful for." Her address is 503 Emily Circle, West Chester, PA 19382. H. Gordon Scowcroft was a frequent golf partner of mine when he and Margaret belonged to the Weston Golf Club in the 1960s. He also played many years in our Class Golf Tournaments. Al Johnson said Gordon was his roommate for three years and was a brilliant student. He added that he and Ruth "are surviving the sunny Florida weather and playing lousy golf."

By this time you have all received your 55th reunion packets. When I called American Airlines about discounts, I found that the correct "Star Number" is S-03604K and that a 5 percent discount is offered. If you belong to AARP, they will give you a 10 percent discount. In any case, we look forward to seeing you. . . . Incidentally, I just learned that my daughter Pamela, her husband Rich Trombino, and three of my granddaughters will be visiting San Diego County in mid April.—Allan Q. Mowatt, secretary, 715 N. Broadway, Apt. #257, Escondido, CA 92025

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Returning to Salt Lake City after skiing Alta with a grandson (not with, really, but rather somewhere behind), I stopped to see Doug Elkins, a Course II graduate student. He was Tau Beta Pi at the University of Utah and joined us in senior year. Doug has lost sight in one eye due to a tumor, but can still drive in daylight. He has a life membership in the Wasatch Mountain Club, and although he had to give up skiing some years ago, he knows the territory well. So we compared Alta, Snowbird, Park City, Solitude, and Brighton, and agreed that Alta is still the best. Doug's career was in the Department of the Interior, overseeing construction of pilot plants, designing dies for powder metallurgy, etc. And in retirement he has the outlook expressed by Walt MacAdam (see October 1989 notes): help the community. Burners of autos and freight cars for scrap were casting a pall over Salt Lake City, so Doug designed afterburners for the hoppers. The excellent results brought observers from far and wide, including some from foreign countries.

Then on to Seattle and a cluster of classmates thereabouts. . . . The first stop was to see Win Scott (Course II) and Elva, who had recently moved from a longtime home to an apartment at 900 University St. Win's work on aircraft power plants took him to Wright Aeronautical until 1955, then to Boeing until 1971, from which he retired in 1985. He had a hand in engine installation and instrumentation on the 707 (and the AWACS version), the 747, and 757. On my way from the airport, I stopped at the Museum of Flight, created out of Boeing's original wooden building and a sparkling new steel and glass structure that houses numerous classic aircraft. Win was a volunteer guide until he and Elva both suffered debilitating illness last year. Win recalled commuting to the Institute by bus, and occasionally when class schedules coincided, he was picked up by Bunk Knudsen and Spencer Mieras as they drove in from Belmont.

Then to the home of Bob Withington ('39) and wife Betsy, who provided a home-away-from-home and a dinner party with their sons and John Alexander ('39) and Nancy. Bob was a fellow 150-pound oarsman, and his crew in sophomore year cleaned up in the Eastern Sprints. I remember his room at Theta Delta's 314 Memorial Dr. house—festooned with opponents' shirts from every rowing college in the East. . . . Also on Mercer Island, a mile or so beyond, I saw Henry Runkle's widow Natalie, who many remember from our 40th and 45th reunions: incapacitated but cheerful. She is in a wheelchair constantly now, but you would never guess it from her radiant face. She has a ground-level apartment, uses a hand-powered wheelchair inside to keep her upper physique strong, and has a motorized chair

to get to the community club dining room, without help. Friends occasionally come in to help with house chores, and trips to the theater in a community van provide diversion.

I was unable to visit **Robert Watt**, but we had good telephone conversation. He joined our Course II with an S.B. from the University of Washington (which his Denny forebears helped to establish in 1861). At Tech he lived in Ware and had meals with his Phi Gam brothers on the Fenway. His interests in the lumber industry span many years, with particular concern for the useful disposal of byproducts—bark, chips, and sawdust to generate power. He consulted for Crown Zellerbach to make such generation a significant power source, and developed a manual for Champion International. Bob Withington and Bob Watt are sailing acquaintances.

North to Anacortes and a visit with **George Ray's** widow Nancy, who showed me models of the VTOL and STOL aircraft George designed at Bell Aerospace before coming to Boeing. She remembers **Joseph King** (also Course XVI) when he and George were at Bell. I thanked her for the interesting items (see January issue) she provided, which added to her tribute to George last year. . . . Then south to Beaverton, Ore. and the home of **Mel Blanchard** (Course III—mining and metallurgy) and Jean. Mal left us in sophomore year for a job in a Mexican mining operation, but the 7,000-foot elevation brought on altitude sickness. So he went to sea level in California and got a degree in business administration at College of the Pacific, where he met Jean. After six years with Bath Iron Works and Bethlehem Steel, he "took the plunge" into construction contracting. Beginning with a \$25,000 job, the business worked into seven-figure amounts, including a \$4 million college building. So another classmate leaves his mark on the land, along with **Art Carota**, **Charlie Hobson**, **Bob Hunt**, **Bill Mullen**, **Nelson Tower**, **Mike Tremaglio**, **Norm White**, and others (let me hear from you). All of you should get your heads together at our 55th reunion—1991. Mal's father was Professor Arthur Blanchard of chemistry, and Mal's son Arthur graduated in the class of '65. So it is not surprising, but still exceptional, that Mal served 16 years as an educational counselor for MIT.

On the way back to Seattle along Route I-5, I stopped to see Mount St. Helens, which blew its top in 1988. The overcast obscured any views, but a good documentary film in the U.S. Park Service Center told it all. And I could picture Malcolm and Jean, on the Sunday before the eruption, standing next to their car in an area that was completely buried a few days later.

I had written to **Kelly Woods** (Course X-A) in Salem, Ore. that I would be near Portland and would like to meet him there. By telephone I learned that he recently had a spinal operation that left damaged nerves and a limp left leg. But he was cheerful and optimistic, saying that the leg is mending! Kelly got an SM and DSc in chemical engineering, and his career in nuclear engineering spanned several locations and activities: Hanford, General Electric Nuclear, coordinating siting plans for the State of Oregon, and eight years as parttime professor at Oregon State University. Before the uprising in China, he was to be part of an American Nuclear Society visit, which did not come off. At our 50th reunion Kelly had renewed his acquaintance with fellow X-Aers **Ed Nicholson**, **John Roberts**, **Bill Rousseau**, and **Ben Woodruff**, who are part of Bill's annual roundup and exchange of letters. . . . When planning this trip I had only a small-scale map, and anticipated seeing **John Rowell** in Oysterville, Wash. and **Ralph Van Sant** in Sequim on the jaunt to Portland. But I later found that each trip would have taken several hours, which my plan schedule did not allow.

Another goof in planning concerns **Ken Cook**, Course VIII, who was in '36 through junior year but finished with '39 due to illness. He wrote to President **Alice Kimball** last July to get the 50th-reunion biographies of our class, "which really

contained a large number of students I knew well." At the time, I made a note to visit him in Salt Lake City, but months later his name and the '38 finish had slipped my mind. This morning, February 2, I found the correspondence. My apologies, Ken, and hopefully I'll get to Salt Lake City again on a trip in our camper.

Season's greetings came from **Henry Lippitt**, who, three months after a heart attack and triple bypass surgery, went right on traveling and hiking abroad with Ruth. But he did retire from active practice of law as executive secretary of the California Gas Producers Association. . . . Also from **Charlie Holman** and Lucy, who is "beating me more often" in skeet shooting; from **Betsy and Harry Essley**, who skied 20 days in the 1988-89 season; **Dorothy and Henry Johnson**; **Henry Wilsey**; and **Gordon Thomas** and Mary Lou, who celebrated Gordon's 75th birthday in Quebec with many friends, including the **Thorntons** and **Koontzes**.

Alice provides a footnote to our tribute to **Martha Williams** last issue: "She and I took theoretical physics together and I graduated in the cap and gown in which she had graduated from Wellesley in 1935. Later she went to teach at the University of Maryland." . . . We are sorry to report that **Thomas L. Blakeman** died January 31, 1990. No further details at this time.

Let's give a toast to the life of **J. Irwin Wagner**, who died in December 1988. He was Course X and had a career in research and development, originally in printing inks, and then for many years at Brookhaven National Laboratory. He won patents for an improved burn ointment and a process for recovering uranium from carbon fuel elements. In World War II he was an Army captain in the C-B-I theater. At Tech he was in freshman and varsity track. I spoke with Mary, who he married in 1981 after 14 years as a widower. She told of his longtime interest in renewable forms of energy—even in retirement, when he planted trees on their farm at Gorham, NY 14461 (Box 48).

Just received February/March *Review*. See pages MIT 6-7 for **Bill Rousseau's** picture and citation as our latest Bronze Beaver recipient: ". . . generous sharing of time and resources. . . is legendary."—**Frank Phillips**, secretary, 1105 Calle Catalina, Santa Fe, NM 87501, (505) 988-2745; **James Patterson**, assistant secretary, 170 Broadway, Pleasantville, NY 10570, (914) 769-4171

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David F. Tuttle, Jr., of Stanford, Calif., writes "Add one more to the roster of cardiac bypass operations. Mine was four months ago, and I have since recovered and gone back to a moderate life: walking several miles per day and a reasonable amount of swimming. I don't envy my colleagues whom I see in the gym with their 5-7 miles a day running at all. Have been retired from Stanford's electrical engineering department over 10 years now. After a few years of journeyman teaching (Georgia Tech, Amherst College, San Francisco State, etc.), I settled down to work on a manuscript on differential equations part of the time and the usual routine otherwise."

Philip H. Peters, Wellesley Hills, Mass., retired as executive vice-president and director, John Hancock Mutual Life Insurance Co., Boston, in November 1980. His hobbies are golf, skiing, tennis and bridge. Phil writes, "just declined to stand for reelection as chairman of Babson College Corp., but am still a member. Still attending board meetings of Greater Boston Chamber of Commerce and the World Affairs Council of Boston, where I am honorary vice-president and vice-chairman emeritus respectively. Love to cut down trees and make mountain road for my tractor on my Jackson, N.H., property. Last year was busy and demanding for Ruth and Phil: "Skiing with family at our Jackson, N.H. home in January and February; Florida in March, Tides Inn and Colonial Williamsburg in mid June followed

by a glorious 5-day house party as guests of our three sons and their wives at the Homestead in Virginia celebrating our 50th wedding anniversary. We spent most of the next four months at our beloved Jackson mountain home. Our oldest grandson, Eric, graduated from Brown, and his two brothers are now juniors at Babson and Colgate. The other six are all blossoming. Thanksgiving was at our Wellesley home with 24-family members aboard. We truly have much for which to be thankful!"

Bardolf A. Storaasli, Durham, N.C., retired from Allis Chalmers in March 1976. He is semi-retired working part-time in a hardware store and doing electrical consulting. His hobbies are woodworking and electronics. Wife Ruth's main interests are doing odd jobs and helping people.

Norman Birch has more than 30 years experience in the American metal casting industry and is a retired metallurgist. Recently, Norm and Elvie, his wife of 50 years, returned from six weeks in Brazil where that expertise was put to good use through the International Executive Service Corps, a not-for-profit organization that recruits experienced executives, usually retired from U.S. firms, to serve in the developing countries as volunteer advisers to locally-owned enterprises that request managerial or technical assistance. The organization, developed in 1965, has completed more than 12,000 projects in 90 countries.

"Norm retired in 1980 after 21 years with Abex Corp. and 10 years with Hayes-Albion Corp. During those years, Birch traveled extensively, directing technical assistance to foundries in South America, Europe, Australia, and Japan. Since 1985, Norm and his Elvie spend winters in Lakeland, Fla., and summers at their lakefront home in Massachusetts. He says, "We really enjoy the Lakeland's fine arts programs. We have the best of both worlds—weather and social life here and summer and family in Massachusetts." Norm and Elvie's family includes two sons, four grandsons and one granddaughter.

Although Elvie participates in many of the same activities her husband does, she is also active in the National Organization for Women and abortion rights. She enjoys a variety of crafts, including ceramics and oil painting. Together the Birches enjoy visiting Elderhostels and have gone to nine or ten of them, including several in New England, Arizona, and Tennessee. Both are interested in enameling on copper, which they went to school in North Carolina to learn. To keep abreast of the metal casting industry, Birch continues his longtime involvement with a number of professional societies and organizations.

Norm exercises and swims, but considers his main function to be problem solving, which includes promoting recycling. "I want to be of service to people," he says, "and if possible to alert the public to be aware of more than 'here and now.' We need more education for young people to change the 'me' attitude and to help them be interested in making better circumstances for living in the future!"

Jane Current writes, "My father **Farmer Lee Current** died on April 2, 1988, from pneumonia following declining health over a couple of years. Our family feels fortunate to have spent much good time together with Dad in recent years. We feel fortunate also to have arranged to donate a tree in Dad's memory to MIT, which we dedicated in November. My mother, **Dorothy Struble Current**, lives at 7 Elgin Place, Apt. 311, Dunedin, FL 34698. We are proud to maintain our ties with MIT." . . . I regret to report the death of **James Freiberg** of New Kensington, Pa., on December 31, 1984.—**Lester M. Klashman**, secretary, Brookhaven at Lexington, Unit 307A, Lexington, MA 02173, (617) 862-4859

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In our November/December class notes, **Horace Homer**, our class president, asked for reactions to

three possible formats for our 55th reunion in 1993. So far the response has been unanimous to hold the off-campus part on Martha's Vineyard.

In the meantime, our 10th mini-reunion will be held at Endicott House in Dedham Friday evening, June 8, 1990 (Technology Day). A limited number of rooms will be available in this gracious chateau for those out-of-town classmates who can stay overnight and through Saturday morning. We'll have ample opportunity to enjoy the lovely grounds and have exclusive use of the house that night. To obtain more information or to register, contact Don or Ed at the addresses below or by telephone at, respectively, (617) 237-9378 or (617) 352-6040.

Bill Shamban in his note favoring Martha's Vineyard reported that he and Sophia had "nothing outstanding" to report. He did, however, enclose a picture of the two of them chatting informally with Prime Minister Margaret Thatcher!

This summer the **Frank Gardners** had to cancel a date at Lake Winnepesaukee with the **Hopgoods** and **Severances** because of an eye operation. I'm relieved to report that after a third cataract operation, his eyes are in great shape. Since then, he and E visited Bogazici University (formerly Robert College) located on the shores of the Bosphorus, cruised the Bosphorus, crossed the Black Sea to Yalta and up the Danube—visiting eight different countries in the course of their trip.

Since we last heard from **Fred Kolb**, he has spent November in France. It began with an El-dorhostel program: a week of study each at the Universities of Caen and Burgundy and at the Louvre. Altogether he studied (in English) French history, French art, and French wine. He topped it off by reuniting with a half dozen of the good friends he has in France as a result of his many trips there for Eastman Kodak over the years.

Now classmates, with hundreds of you retired or about to be, surely there are trips or new hobbies or accomplishments that the rest of us want to hear about—so do write. Or if that seems too much like work, how about giving Ed or me a call.—**Don Severance**, secretary, 39 Hampshire Rd., Wellesley Hills, MA 02181; **Ed Hadley**, assistant secretary, 50 Spofford Rd., Boxford, MA 01921

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Dick Leghorn was recognized in *MIT Management Magazine* for establishing the Richard S. Leghorn Management of Technological Innovation Career Development Professorship. After graduation, Dick joined Eastman Kodak, served in World War II, and co-founded ITEK to make photographic and electronic equipment for the aerospace and office products industries. He built and owned cable television stations in five States. He founded Cable Television Laboratories, Inc. He founded EDAC to develop copyright protection systems for television programming. With Jerome Wiesner, MIT president emeritus, he is collaborating on Magnascreen, a company they formed to develop flat screens for high-definition TV.

George Cremer sent me his copy of the February 1989 issue of *Physics Today* in which **Richard Feynman** was honored, post-mortem, by its cover picture plus 66 pages of tributes. A distinguished group of Feynman's colleagues spoke at an all-day memorial session on January 18, 1989, in San Francisco to a joint meeting of the American Association of Physics Teachers, the American Physical Society, and the American Association for the Advancement of Science. Each member of this distinguished group also contributed his reminiscences of his associations with Feynman to form a most-inspiring 66-page record of professional respect and admiration.

Mary and Seymour Sheinkopf, in retirement, continue studies at the University of Maryland where Seymour is studying basic computer programming and Sylvia pharmacology. They plan a cross-country tour in their motor home. If

they'll be here long enough, we might just phone around for a mini-reunion. And if **Norma and Morrie Nicholson**, from Minneapolis, and **Margaret and Win Reed**, from St. Louis, and **Eugenia and Fred Cooke** from Cross Junction, Va., should happen by, we might add a mini song-fest.

Seymour relayed information that **Mary and Martin Lindenberg** were not listed in class notes as having attended our 50th reunion. They were there. We're glad to set the record straight and look forward to seeing them at the 55th.

Sidney Roberts is professor of biological chemistry at University of California School of Medicine at Los Angeles and also serves as chairman of the Academic Senate.

My informal record shows about 368 (or 66 percent) of our 1939 class are living, as of Valentine's Day 1990. Some people who study actuarial tables say, for those born around April 1, 1916, the average life expectancy is about 18 more years. That's time enough to enjoy the rewards that come from making the extra effort to set up a dinner and an evening with a special classmate and longtime friend.—**Hal Seykota**, secretary, 1701 Weatherswood Dr., NW, Gig Harbor, WA 98335

40

50th Reunion

From Hinsdale, Ill., **John McKee** writes that he and wife **Eleanor** are moving in February to Cherokee Village, Ark., to build a retirement home on a lake. **John** is looking forward to rowing his Alden single for exercise. . . . **Richard Co-bean** sent me a copy of his Christmas letter from Libertyville, Ill. **Dick** has spent much of the last year traveling to visit children and grandchildren, mostly in the East. He attended a family reunion in Gettysburg, Pa., where an ancestor was the first president of the Gettysburg National Bank in 1820. Currently he is building an airplane that he expects will be ready for flight this spring.

I had a letter from **Marion (Mrs. Garrett) Wright** with more details on Garry's background and accomplishments. Garry was, indeed, an outstanding person, both in his business life and his civic efforts. We shall miss him sorely at the reunion. . . . I must also report the passing of **Charles W. Lindblom** of Granada Hills, Calif., on December 19, 1989, after suffering from Parkinson's Disease for nine years. His wife sent a donation in his memory to be used in medical research. The class sends its sympathy to the family.

David R. "Beano" Goodman of Madison, Ind., writes of his peregrinations to Israel, Canada, and California. He is still spending about half his time "harassing" his son, who is now running the chemical business "better than I did." He recently had an opportunity to renew his old interest in wrestling. I have also spoken with him about plans for our 50th reunion. . . . **Walter Kahn** telephoned to talk about options for staying in Cambridge during the reunion. He said he sent in his red jacket order by return mail! . . . **Gerald J. McCaul** called from Lighthouse Point, Fla., to talk about the reunion. His son is being married just a couple of days before we are to meet in Cambridge, so it may be tight for him. I hope that Gerry will be able to be with us for the entire week. Apparently, a few people did not get the reunion questionnaire in the initial mailing. I hope most of you were able to complete it to be included in the book that is being prepared. . . . **Wesley W. Pendleton** of Zephyrhills, Fla., wants to be included in the book. He and his wife of 50 years plan to be present. He attends gatherings of Florida alumni and is anxious to have his red jacket to join those other senior alumni at the meetings.

By the time you receive this, it will only be a few weeks prior to the reunion. I hope that a large number of you will be there. It looks as if it will be a really great week! In the meantime, please keep those letters and phone calls coming for information and insertion in future columns. And it is never too late to get in your class gift—

or even to add to it.—**Richard E. Gladstone**, secretary, 1208 Greendale Ave., Needham, MA 02192, (617) 449-2421

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Our 50th reunion planning is going ahead. The committee includes **Johan M. Anderson**, **Ivor W. Collins**, **David W. Howad**, **Mitchell J. Marcus**, **Edward R. Marden**, **John F. Sexton**, **D. Reid Weedon**, **Leona R. Zarsky**, and yours truly. A reunion yearbook is in preparation, and you will receive biographical data sheets as well as a questionnaire for statistical data to make up a class profile. Please begin searching your files for photos, old tests, and stories to help us remember those times long ago.

Albert Bensusan writes, "Presently on the way south in our sailboat; plans are open-ended, except that we hope to be home in the spring. Have been retired since 1985, but finally got Clair to take a year off. Have seen **Martin Ernst** and **Dick Lazarus** within the last six months." . . . **Stanley Jarow**, my old buddy, writes, "Still working. Am still president of Jarow products. We manufacture plastic extrusions. Am on the board of Michael Reese Hospital, Chicago. Have a 36-foot cabin cruiser in Chicago and small fishing boat in the Florida Keys. Devote as much time as possible to boating. I teach in the U.S. Power Squadron, a boating group."

William D. Potter died last year. Bill was a chemist at Hanscom Air Force Base and an amateur magician. He enjoyed performing magic tricks for his family and friends. Bill was a member of the American Association for the Advancement of Science, the American Chemical Society, and the Air Force Association. He is survived by his wife, Ruth, four sons, and a daughter. . . . **Larry C. Lord** of Lago, Fla., died last year. He is survived by his wife, Ellen, a son, a daughter, three grandchildren, and a great-grandson. . . . **Alexander Forbes Robb** died last year.—**Joseph E. Dietzen**, secretary, P.O. Box 790, Cotuit, MA 02635

42

I met **Walt "Sid" Eberhard** at the MIT Club luncheon in Sarasota. He's living in Sun City, looks great, and keeps busy with all manner of activities. Walt is a wonderful ad for Florida retirement living. I had dinner with **Hazel and Fred Gander**, who have a villa just north of here in Dunedin. Both are playing tennis every day and saw the slide show of their 1989 trip to the Galapagos Islands.

Bob Fay had a total knee replacement that was successful enough that he can walk and swim fine but, sadly, tennis is out. Bob was in Florida for the Trademark Lawyers' Conference and in Honolulu for the American Bar Association's annual meeting. . . . **John Barry** retired from A&P and now spends a day a week doing consulting with the food industry. He plays tennis about five times a week and is busy managing and rebuilding the golf course at the South Shore Country Club in Hingham. Still honest to a fault, John notes that Marge is still a better golfer than he.

Bob "Hawk" Shaw is working on the Harvard Medical School class of 1945 reunion and tells us that **Bob Rines** and **Mort Goulder** are on the board of New Hampshire's first and only law school. . . . **Donn Barber** writes that he and **Sis** visited **Muzz** and **Earle Foote** in Seattle after spending a month in Maui. . . . **Adrian Marcuse** met **Floyd Lyon** (and new wife) at the local garden supply store on Long Island. Floyd is still president of Halm Industries in Glen Head. Adrian is "still gainfully employed" at the Laboratory Institute of Merchandising in New York, which provides him with an annual trip to London and Paris. . . . **Carl Meurk** has retired from Todd Shipyards. He was a vice-president there and su-

pervised Todd's shipyards in Los Angeles, San Francisco, and Seattle. . . . **Bill Muir** died in Waltham, Mass. He was a radar technician during World War II. After the war, he was associated with The New England Electric Co. . . . **Cenan Sahir**, Course II, died in his native Istanbul, Turkey. Our sincere condolences to the wives and families of these classmates.—**Ken Rosett**, secretary, 191 Albemarle Rd., White Plains, NY 10605

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Frederick F. McWilliams died last August 13 in Boise, Idaho. The report came from his wife Elvira, to whom we extend our condolences.

A note from **Richard J. Zeamer** tells of his retirement August 30, 1989, from his position as project engineering manager at Hercules Aerospace Co. in Salt Lake City. Dick is now busy running his own engineering business, Applied Science Associates. . . . **Robert A. Nelson**, Concord, Mass., asks what has become of the Community Service Fund, which he has supported for several years. He hasn't seen an annual report since 1980. Can anyone answer his question?

Once again we return to the thrilling days of yesteryear (October) and the next chapter of the "Over-the-Hill Gang in New Mexico." Sunday morning we formed up the wagons at Attinger's Station for a caravan to Bandelier National Monument and its ancient cliff dwellings, a distance of about 80 miles. After passing Bernalillo, San Ysidro, and spectacular mountain scenery, we paused at Jemez Springs. These are located along-side the highway in the caldera of an ancient volcano, much like Yellowstone Park. Hot water bubbles seep and flow over a wide area, leaving behind a sulfurous odor and fantastic geological formations.

It was lunchtime when we arrived at Bandelier, and we enjoyed excellent picnic baskets, including wine, provided by perfect hostess, Sue Ottinger. Following our repast, some rested in the shade while the more energetic tramped around the Indian ruins, reading signs and mounting cliffsides to look inside dark, dusty holes.

We mounted up again and proceeded to Rancho Encantada, a few miles northeast of Santa Fe. This is a group of time-share condos where we spent the night. Late that afternoon, once more guided by Ottinger cartography, we made our way to the Santa Fe home of Mary and **Clark Hulings** for cocktails. Clark is Sue's brother, a prominent and highly successful artist who can hardly keep up with the demand for his paintings. Several of us acquired copies of his beautiful art book, which cannot be found in B. Dalton's. The Hulingses were charming and gracious hosts.

Stan Proctor and the steering committee are getting serious about the 50th reunion gift, so you all "get receptive."—**Bob Rorschach**, secretary, 2544 S. Norfolk, Tulsa, OK 74114

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Lamar Field writes that he retired as professor of chemistry from Vanderbilt University in 1989 after 40 years of service. He has retained his office for work on several editorial boards and also has kept a personal lab, where he hopes to find time for research with his own hands instead of those of the 80 or so that have been in his research group over the years. Along with various volunteer work, Lamar continues to provide consulting services. . . . **Tom Lawson** and his wife Nancy enjoyed a wonderful MIT-sponsored trip last summer to France and England, including a cruise down the Seine from Paris to Honfleur. They were in Paris during the bicentennial anniversary celebration and watched the massive fireworks display from the top deck of their cruise boat (probably the best seats in Paris).

Dean Dragsdorf retired in May 1988 after 40 years of teaching and research at Kansas State

University. He attended the Bermuda part of the 45th reunion last June. . . . **Robert Benedict** retired to part-time management consulting in early 1988, but the retirement was shortlived. In 1989, his former employer called him back as chief operating officer, president and chief executive of its major (and ailing) subsidiary. So as these notes are being written, Bob is doing some commuting from the sunny southern California desert to frigid New York City. It keeps life interesting, even exciting. He is not alone in visiting chilly places.

Stan Warshaw is on his way to Moscow to explore the possibilities of a joint venture with the Soviets in roofing materials. We look forward to hearing about his experiences. . . . **Andy Corry** is leaving the temperate clime of Cape Cod for a consulting assignment with the State Power Board in Iceland. By the time you read these notes, Stan and Andy should be thawed out.

We have one sad note to report. **Stanley Pasternak** (Course X) passed away in November 1987. We have no details.—Co-secretaries: **Andrew Corry**, P.O. Box 310, W. Hyannisport, MA 02672; **Louis Demarkles**, 77 Circuit Dr., Hyannis, MA 02601

45

45th Reunion

Please send news to your class secretary.—**Clinton H. Springer**, secretary, P.O. Box 288, New Castle, NH 03854

46

Not much going on this month other than a brief note from **Sam Meerbaum** via the *Tech Review* pipeline. We wrote about Sam some while back, noting his productive life in cardiology after emerging from his bioengineering career in aerospace. In retirement, Sam is into landscape painting, among many activities, with lots of plans for the future. The Meerbaums have been living in Woodland Hills in southern California's lush San Fernando Valley the last 25 years or so.

Thumbing through the archives, for possibly the last time, it looks like I've overlooked **John Sullivan**, an emigre from Braintree, Mass., who came aboard the good ship V-12 to become a civil engineer. After his commission, he was assigned to the tough job of a supply officer in Charleston. Very heavy, hard duty, eh John? Anyway, he moved out and on to a year's "stop over" in a Boston firm before spending the next 34 years with Standard Oil's Creole Petroleum Corp. to build roads and such through eastern Venezuelan jungles. He met his wife, Lee, there while she was teaching in Creole's American school system. They have four sons and a daughter, all graduates of different eastern colleges! John and Lee retired to Houston, Tex., in 1982 and have a summer/fall place in Eastham on the Cape. Sounds like a nice arrangement.

Th-th-that's all, folks.—**Jim Ray**, secretary, 2520 S. Ivanhoe Pl., Denver, CO 80222

47

Israel M. Cramer died last November. He was a resident of Columbia, Md., and employed as a systems design analyst by the U.S. Treasury Department at the time of his death. He is survived by his wife, Margo, his mother, two sisters, and four brothers.—**Robert E. McBride**, secretary, 1070 Pilgrim Pkwy., Elm Grove, WI 53122

48

Jean and Warren King have moved into their new winter home in Rancho Mirage, Calif. They usually spend summers in Winnetka, Ill., but this year they have rented a house in Lake Sunapee, N.H., for July. Their younger daughter recently

gave birth to their second grandson in Burlington, Vt. . . . **Betty and Bruce Moseley** now have their first grandchild. Although they had been looking forward to it for some time, they were surprised by the immense depth of feeling that comes with holding the first grandchild. Since retiring from Proctor and Gamble, Bruce has been busy with church and genealogy work. He has traced his roots to a Moseley who came to Virginia in 1642. They recently attended church at Smyrna UMC in Lowndesville, S.C., becoming the sixth generation of his family to worship with that congregation. . . . **Herbert Schneider** retired from ATR Bell Labs after 42 years of stimulating work on land, in the air, and under the sea.

Rudge Allen died in January at his home in Houston. A few career highlights: after serving in the Air Force, he was an employee of Humble Pipe Line Co. and in 1961 joined Faye Sarofim & Co. Faye Sarofim managed financial matters for their clients and were known for excellence in achieving generous returns on the investments they managed. Rudge became a director and executive vice-president. In September 1989, Performance Analytics reviewed money managers for the period ending June 30, 1989, and Rudge's firm was ranked 10th of 1,500 managers on the basis of realizing 34.60 percent. During the same period, the S&P 500 rose 20.39 percent.

Rudge was active in MIT's affairs. He served in more than 14 assignments and for 18 years was a member of the Corporation Development Committee at MIT. His term as a member of the MIT Corporation began in 1987 and would have continued to at least 1992. He was also a founding member of the Houston Area Apple Users Group and a director of Community Health Computing, Inc. He was active in the Houston Society of Financial Analysts, a charter investment counselor, a trustee and former president of the Children's Museum of Houston, a trustee of St. Luke's Episcopal Hospital, and a member and past vestryman of St. Martin's Episcopal Church. He was also a director of the Bayou Club, a member of the Houston Country Club, The Ramada Club, Allegro, and the Galveston Artillery Club. Rudge and his wife, Nancy, had three sons. On behalf of our classmates, I extend our sympathy to Nancy and the rest of Rudge's family.

Albert Davidson worked in consulting engineering firms after graduating with our class. The majority of his experience was in heavy industrial construction, including power stations, wharf, and bulk handling facilities. During the seven years that he worked in his father's consulting firm, he designed several long-span steel arch-roof gymnasiums and hangars, in addition to general factory construction and alterations. For the last 25 years, Albert has been at Gruman, working on applications of computer methods for static and fatigue analysis, and recently on computer databases to track expended fatigue life for military aircraft. He found the work interesting and extremely varied, but it is not "engineering" as he studied it 40 years ago. Albert and his wife, Rhea, have enjoyed a happy marriage for the past 33 years. They raised and educated three fine children and started them on their own careers in business, environmental management, and electrical engineering. They have done some traveling in the U.S., Canada, and Europe. They plan to continue working and hope for continued good health. They also plan to continue traveling, sight-seeing, and visiting with old friends.

Jim Guida recently enjoyed two weeks in Padua, Italy, and the surrounding regions of Venice, Verona, Vicenza, Ravenna, and the Italian Lakes. He uses Elderhostel in planning and implementing trips. . . . **Buckley Collins** is semi-retired. He continues developing and investing in real estate in Port Huron, Mich. . . . **Walt Chaiko** is retired, and he and his wife, Barbara, live in Fairfield Harbour, near New Bern, N.C. Walt does some consulting, and they have a 32-foot Bristol sailboat. They are having a great time sailing, gardening, traveling, etc., and they

invite old friends to please visit. Their son is flying helicopters, and their daughter is with IBM in marketing administration.

Richard Smith and his wife are living in Sherman Oaks, Calif. Richard retired (professor emeritus) from California State Polytechnic University in 1985, after 24 years. He is now working as a consulting software engineer for McDonnell Douglas, where he works on C-17 software design and documentation. . . . **Ezra Garforth** and his wife, Edna, were in Paris when hurricane Hugo hit their home in Charleston. There was no major damage to their home, and good neighbors cleaned up their property. They avoided the 14-day period when there was no electricity.

I am writing these notes on my Macintosh computer and, with a modem, will transmit them to the Review office. This afternoon, I raced my Sunfish sailboat with 12 other sailors in our Frostbiting series. We race in the Barrington River, where it widens before entering Narragansett Bay. I have been racing with this group on Sunday afternoons from October to April since 1978. Today we had partial whitecaps (17 knots of wind) and a temperature of 34. The ice that formed on the sail broke up easily during every tack. The ice on the deck was easily pushed away as I moved around. I outlasted two boats and beat an additional one or two boats in some races. Four other boats capsize in the gusts. Hot chili was most welcome when we gathered in the clubhouse, as well as a creme-filled éclair. When I returned home, I checked my blood pressure (as measured after sailing in the past), and it was distinctly lower than during the week.

My third career as a manufacturer's rep has allowed me to harvest a lot of friends, fun, and funds. I sell products that include a cryopump that operates at -140C, an ion source that can be focused to 500 Å (0.05 micrometer) spots to micromachine and repair circuits on integrated chips, and a computer that can control 50 to 1,000 channels in vacuum systems used for semiconductor fabrication. After a training session and plant visit with one manufacturer, I had two crystal clear days while hiking on Mt. Rainer. After another similar session, I enjoyed two days on the Continental Divide in Rocky Mountain National Park. My pedometer counted over 22,000 steps that day. On New Year's weekend I hiked on Mt. Washington in New Hampshire. The temperature was a mild 25, but there was a 30 mph wind when I reached Hermit Lake.

In early October, I spent a week with both my sons for the first time since 1972. We sailed Larry's 56-foot Bristol ketch from Newport, R.I., to Palm Beach, Fla., in eight days. We set an offshore course out to sea. Cape Hatteras was close enough to show on the radar, but it was below the visible horizon. A year earlier our trip was enlivened by 25-foot waves and 40-50 knot winds. This year we had a favorable wind on our beam or our stern the entire trip.—**Marty Billett**, secretary and president, 16 Greenwood Ave., Barrington, RI 02806, (401) 245-8963

49

On January 5, 1989, it was snowing here in Needham, Mass., as I sat down to write about **Walter Seibert** and **Jack Fogarty** for the April edition of the Review. And now, 13 months later (February 15, 1990), it is snowing again as I contemplate notes from both of these gentlemen once again. If I heard from others with such yearly regularity, writing this column would be easy.

Walter writes: "We are enjoying retirement more than ever, although we seem to have more to do than when we 'worked.' We are still looking for the ideal retirement spot, so we are staying quite mobile while we share good health." . . . **Jack Fogarty** has acquired a complete computer system with all the software you could ever want and has marked the event by writing me the longest letter I have ever received. He also encloses three comic strips poking fun at the gibberish

employed by computer types when they write or talk. Jack and his wife Peggy are taking computer courses at Howard Community College in Columbia, Md., she in WordPerfect 4.2 and Jack in MS-DOS. Jack is a fellow engineer with the Westinghouse Advanced Technology Lab in Baltimore. He's been "on loan to the optics group for the past year working on a residue number system optical computer. It uses look-up tables employing fiberoptic 'plugboards' for the computation." He says, "Don't ask me to explain residue arithmetic (just don't calculate my paycheck with it!), but I'd be glad to discourse on the laser drive for the fibers..."

Dave Moore has fallen upon hard times, but things are looking up. He had a total knee replacement in September 1989 and a mild stroke (speech disfunction only) in November 1989. His speech is getting better every day. Dave, you have our total sympathy and best wishes.

Bill Hecht, executive director of the MIT Alumni/ae Association received a note from **Frank Cole**: "My no. 9 child is at the University of Pennsylvania. My no. 10 child will start college in 1991." For now, Frank indicates, he has solved the nagging problem of what to do with spare cash that might otherwise just clutter up the house.

Harold McInnes has become chairman and chief executive officer of Amp, Inc., in Harrisburg, Pa. Harold was formerly vice-chairman of the company. The important thing about Harold, so far as our class is concerned, is that he recently agreed to be our estate secretary. **Tom Toohy**, our class president, was guided by Course XV principles when he picked a busy man to do this important job.—**Fletcher Eaton**, secretary, 42 Perry Dr., Needham, MA 02192, (617) 449-1614

50

40th Reunion

Please send news to your class secretary.—**John T. McKenna, Jr.**, secretary, 9 Hawthorne Place, Apt. 10H, Boston, MA 02114

51

An exhibit of over 60 of the kinetic sculptures of **Jerome Kirk** at the Walnut Creek Art Gallery in Oakland triggered an article that we received on our classmate's work and career. He was originally inspired by an exhibit of Alexander Calder's mobiles that was held during our freshman year. His art career began after hours while he held positions at Ford and Space Technology Laboratories. By 1966, successful exhibits allowed him to pursue his artistry full time. Over 2,000 of his kinetic sculptures can be found throughout Europe as well as the United States. Some of his large scale works have been placed on outdoor public display. In the article, he explains how he calls upon his knowledge of structural engineering in the design of these larger outdoor efforts. Even in the black and white copy of the article, the pictures of his work are striking and beautiful.—**Martin N. Greenfield**, secretary, 25 Darrell Dr., Randolph, MA 02368

52

For some reason, the Student Financial Aid Office sends its annual report on the Class of '52 Scholarship Fund to **Art Turner**, who forwards it to me to report to you. The fortunate result is that I hear from Art more often than I otherwise would. As Art remarks, the fund seems to be helping an unbelievable number of students. Two recipients, **Bill Jarrold** and **Joanne Chee**, graduated last year, and **Daniel Loera**, who is absorbing the current year's income of the fund, should graduate this June. The office's letter says, "We not only appreciate the monetary support for the scholarship program, we especially appreciate the alumni-student connection. I am sure you and your friends of the class of '52 are building

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loyalty among these future alums." We currently loyal alums are encouraged to continue our support for the fund; scholarship aid is a perpetual need.

Dan Lufkin writes, "I'm still satellite mongering at Fairchild Space Co. and translating German PhD theses on geodesy on the side. Nasty work, but someone's got to do it."

I was sorry to learn that **Herb Teager** died of lung cancer last January 8. He was a research professor at Boston University Medical School, and head of biomedical engineering at University Hospital. Before joining BU in 1966, he taught electrical engineering at MIT, and continued as a lecturer there until 1982. His specialty was speech acoustics, and he had been working on voice recognition systems and diagnostic methods using speech acoustics. He is survived by his wife Shushan, '54, and two sons.—**Richard F. Lacey**, secretary, 2340 Cowper St., Palo Alto, CA 94301

53

I received a long newsletter from **Larry Lewin**. He enjoys the news items he has seen in the *Review* about his old friends. His letter is among those coming to me from afar, Tel-Aviv University. He was appointed Chairman of the Chemical Pathology Department at the Tel-Aviv University Medical School on January 1, 1988.

Larry lectures on vitamins, carbohydrates, minerals, liver function, etc. His research has led to a trip to Germany, India, Thailand, and Singapore during last summer. His wife, Bev, has been doing some administrating and teaching in the University Mechina (preparatory) program and has been teaching a course in scholarly writing for doctoral candidates. I could use some of that for these notes.

Their son, Josh, has completed military service and is a student of physics at the university. Their daughter, Ilana, is working with the Sociology Department taking surveys and analyzing the results. Daughter Alisa is working on finishing her MA thesis in sociology and is applying for PhD studies to various U.S. universities.

Larry was rather philosophical about the significant world events that have occurred in the last few months, especially as they relate to the Middle East. He also commented on the growing up of children and their search for independence, very much like comments I've heard or seen in letters received from other classmates.

Stan Zisk accepted a faculty research professorship, planetary/scientist, at the University of Hawaii, Planetary Geosciences Division of the Institute of Geophysics. Needless to say, he lives in Honolulu. Anyone going that way might look him up. I may even do it myself sometime in the next year or two. My son, Patrick, and his wife are expecting to go there for a three-year tour. His wife is a government geologist (PhD) who is into the care and study of volcanos. Patrick is going along for the experience. His current job is with the Chesapeake Bay Foundation as an environmental lawyer. He hopes to continue in this line or get a job teaching in a university. . . . A letter from **Grayce** and **Sid Hess** reports that Sid is full-time at Drexel University teaching management and telling graduate students how it really is out in industry. Grayce is fund-raising for the Rockwood Museum. Their children are scattered. Diana and Mark are now homeowners in Annapolis, Md. Mark is in practice as a psychologist in Baltimore, and Diana is a physical therapist in a sports complex in Annapolis. Son Peter is a bachelor who has opened his own practice specializing in maritime and salvage law. Debbie and Bob have two wonderful daughters who spent much of the month of August with Grayce and Sid at the beach.

In January 1989, Sid and Grayce took time out to join an expedition to Antarctica. Grayce says, "Words can't describe the sights we saw or the experiences we had. Every minute was an adventure and a discovery. Standing amongst hundreds

of thousands of chattering penguins, gliding through forests of icebergs, experiencing that majestic frontier—the whole trip surpassed even our wildest dreams." They have edited the video and film down to a manageable "program," and they re-live the experience everytime they show it.

Maybe someone out there will suggest that they bring the show to the next reunion, and those of us who do attend the 40th can share in the majesty of Antarctica. It might be interesting to have a showing at the next reunion of the collected video footage of strange and wonderful places classmates have been.

Remember, these notes are interesting only when you all send me items about your activities and achievements. Drop me a line or give me a call when you are in town. The recorder at the number below has a message for my wife's company, Arcadia Realty. Leave your name, phone number, and mention your MIT 53 affiliation. I'll get back to you. **Jay Berlove**, by the way, is dropping by this weekend while he is attending a major coin show in Baltimore. You can too.—**Gil Gardner**, secretary, 1200 Trinity Dr., Alexandria, VA 22314, (703) 461-0331

54

Retirement seems to be the thing for our class at this point. . . . **Marty Brilliant** writes that he has taken early retirement after 24 years with Bell Labs and is looking for a new career. . . . **Ed Markowski** retired three years ago and is growing avocados in California. . . . And **George Schwenk** has retired as a scoutmaster after 15 years of service to the B.S.A., according to Crathern, the Schwenks' cat who writes their annual Christmas letter. (We're a little late in reporting holiday letters this year.) Crathern also informs us that George traveled to Pennsylvania and Virginia last year for Boy Scouts events, before he retired from active participation.

Elaine Griffin sent her usual holiday letter, which was mostly about tennis and golf and the five younger Griffins. Apparently, all that Roger does these days is play golf and go "his merry way." The whole family is doing well, though. . . . Drop me a note and let us know how you are doing.—**Edwin G. Eigel, Jr.**, secretary, 33 Peppercorn Lane, Fairfield, CT 06430

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35th Reunion

It is with sadness I report that another of our classmates, **Harvey "Ted" Hoshour**, died in December 1988 at his home in Albuquerque. His firm designed many of the significant public buildings in Albuquerque and had been working on the future performing arts center. Ted received a Fullbright Scholarship in 1955 to study under Pier Luigi Nervi in Rome. From 1957-1961, he worked for such noted architects as Mies Van der Rohe and I.M. Pei. In 1962, he moved to Albuquerque, where he established his own firm. He is survived by his wife, Lise.

The pre-reunion activities have helped us keep up on the going-ons of our business classmates. **Sandy Goldman** tells us that he has two children in college and two other school kids. His wife, Mary Glen, is an assistant manager of Development at the Boston Symphony Orchestra. His 1985 start-up, T-Mac, has spawned a new group called Techniscribe, which publishes operator and service manuals for advanced technology companies. He also spent three weeks in Wyoming, Colorado, and Utah and says, "Sandy Goldman on a horse on a 9,000-foot-high Rocky Mountain trail is a most unlikely scenario, but it really happened." . . . **Elisha Huggins** has been working for the past five years turning the Macintosh computer into a laboratory oscilloscope. The aim is to bring Fourier analysis into introductory physics. The result, Mac Scope, won the N CRIP-TAL, best physics award of 1989. Elisha still lives

in Moose Mountain near Hanover, N.H. . . . **John Dixon** has completed 17 years as editor of *Progressive Architecture* magazine. His highlights for 1989 were a trip to China in February and two trips to Japan.

Martin Shooman is in his 32nd year of teaching at the Brooklyn Polytechnic University. The Chinese and Japanese versions of his book, *Software Engineering*, were published in 1989. The second edition of *Probabilistic Reliability* will be published early in 1990. . . . **Harvey Farrah** was appointed chairman of the Electrical Engineering Department at Lawrence Technological University in Southfield, Mich. . . . **Richard Forrester** is now vice-president of Alpha Associates in Wellesley Hills.

The reunion questionnaires brought us the following information. **Lawrence Ingber** informs us that he married Lieba Klaff in 1976 and has one grandson, born in 1988. . . . **Lester Lee** has returned from entrepreunering to engineering: he is working for the U.S. Department of Energy. . . . **John Lindenlaub** was elected a fellow of the American Society for Engineering Education in June 1989. . . . **Jack Linder** is still enjoying retirement in Sarasota and the lifestyle, including lots of tennis and travel. . . . **Barry Lucas** is director of marketing for North American and Mexico for Pratt and Whitney. . . . **T.A. Marlow** is still in New York with the Metropolitan Transportation Authority but transferred from subways and buses to vice-president of the Capital Program at Long Island Rail Road. Most important he has two grandchildren, one of each sex. . . . **Dick McCammon** is president of the International Association for Mathematical Geology (IAMG) for the period 1989-1992 and the program chairman of the 25th Anniversary of IAMG being held in Prague, Czechoslovakia, in 1993.

This column will be arriving at the time of our 35th reunion and, for all those that couldn't make it, we will do our best to bring you up-to-date on old friends and acquaintances.—Co-secretaries: **DuWayne J. Peterson**, 201 E. 79th St., Apartment 11-I, New York, NY 10021; **Robert P. Greene**, 100 Memorial Dr., Apartment No. 11-2A, Cambridge, MA 02142

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Attilio Castano is semi-retired with two sons who are Georgia Tech graduates and a daughter who is a sophomore in architecture at Guayaquil's Catholic University. . . . **Fred E.C. Culick** and wife have opened a sports store concentrating in skates, activewear, etc. to go with their skating rink (majority owners) and his wife's music store. A nice alternative, "occasionally," to the academic life. . . . **Curtis B. Flory** continues as president of Zircon Co., Inc., Woburn, Mass., and has recently been affiliated as president of the board of trustees at Danvers State Hospital.

Gordon Kane is president of Computer Optics, Inc., in Hudson, N.H. (At least one classmate has a hankering to know why he is called "Donny" to friends and wife at conventions, including one at Orlando, Fla.). . . . **Marlin E. Lickhalter** is managing partner of Stone, Marracini & Patterson's St. Louis office, one of the nation's largest architecture and planning firms. . . . **D. Bruce Montgomery** has received an IEEE Fusion Award. He is associate director of the MIT Plasma Fusion Center and head of the center's Technology and Engineering Division and has become the first recipient of the Annual Fusion Technology Award sponsored by the IEEE Nuclear and Plasma Sciences Society. The award cited "pioneering contributions to high field magnet development for both the Alcator tokamarks, for broader fusion applications, and for excellence in engineering management and oversight." Bruce was also praised for other work in related fields. He has been at MIT since 1961, holds a BA (1955) from Williams College, SB and ME (1957) in electrical engineering from MIT, and ScD (1967) from the University of Lausanne.

Edward S. Purcell, Jr. is still working for the USCG at the R&D Center, Groton, Conn. Colleagues and Ed have just received an award for the best paper of the year from the Society of Naval Architects and Marine Engineers. . . . **Craig Sherbone's** son, Evan, is graduating from MIT in mathematics after three years. Evan considered staying on for a fourth year as an undergraduate for a fourth year of volleyball until dad promised a lifetime supply of volleyballs for graduating early. Evan hopes to stay at MIT for graduate school. Craig and Rosalie are looking forward to the next reunion. . . . **Danny Wolfson** is president of H.R.H. Construction in New York City and, from all evidence, is doing more work in Manhattan than everyone else combined.

Thanks to all for your continued input to our column. May the grass be greener wherever you are.—**George H. Brattin**, secretary, 39 Bartlett St., Andover, MA 01810, (508) 470-2730; **Irwin Gross**, assistant secretary, Sweets McGraw-Hill, 1221 Ave. of the Americas, New York, NY 10020, (212) 512-3181

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Please send news to your class secretary.—**John Christian**, secretary, 23 Fredana Rd., Waban, MA 02168

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Hard to believe that spring is back so soon. But it must be, because I'm back out on Lake Mendota rowing with our four-man and eight-man crews, busily training for this year's racing season. Last August, I rowed with the Mendota Rowing Club at the U.S. Masters Rowing Championships in Oakland, where we won a silver medal in the mixed fours (43-59 age group) and placed fifth in the men's eight (43-49 age). During this three-day event, Nancy and I chatted frequently with **Pete Peterson**, who was rowing with the Cambridge Boat Club. Pete won three gold medals in the men's quad, double, and pair events, and placed fourth in the grand master single in the 50-54 age group. By the way, Pete and I heartily recommend rowing as an overall fitness activity because it provides a full aerobic and strength workout without any impact on knees and ankles. You can sign up for a beginners' course at almost any of the 300-plus rowing clubs around the country.

International news tops this month's mail bag. We received a note from **Richard Glantz** saying, "I've been promoted to senior engineering manager, Far East Region, for Digital Equipment Corp. I'll be based in Hong Kong and will be moving there this month." . . . From Costa Rica, **Mel Copen** sent along encouraging news. "I'm still enjoying Costa Rica and my work with INCAE. We provide management programs at the graduate level and executive seminars for Central America and much of Spanish speaking Latin America. We're heavily involved in economic and social development, and in building dialogue across sectors and national boundaries. It's an organization that is truly making a difference in this much-troubled region."

While it wasn't exactly the Tour de France, it was just as exciting for **Toby Carlson**. "This past May, I was able to do something I had been dreaming of for a few years. With my wife's encouragement, I played a vagabond and set off on a two-and-a-half week biking trip across France. A graduate student from Penn State and I cycled from DeGualle Airport north of Paris to Montpellier on the Mediterranean, just west of the Mar-seilles. It was a wonderful and exhilarating experience." . . . **Bob Baber** sent a note saying that the Polish translation of his first book, *Software Reflected: The Socially Responsible Programming of Our Computers*, was published in 1989.

Arthur Zimmet writes, "I am currently senior vice-president, Special Projects, with E-Z-EM Inc.

in Westbury, N.Y. I am heading up a group working on unique, minimally invasive therapeutic devices to be used in radiology and surgery. I would like to hear from other classmates and alumni who might be working in this same area." . . . **Tom Wollny** reports that his consulting firm, Quick Reaction Corp., continues to broaden its services to government and industry in RCS signature prediction, measurement, and evaluation. It wasn't covered in 6.18, but Mike's law of communications still applies: "No news from you is no news from me." Dictate some news to your secretary or ask your significant other to write something up and send it along. That's all this month.—**Mike Brose**, secretary, 841 Magdeline Dr., Madison, WI 53704

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Please send news to your class secretary.—**Allan S. Bufferd**, secretary, Office of the Treasurer, MIT, 238 Main St., Suite 200, Cambridge, MA 02142

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30th Reunion

Given the recent paucity of information for the class notes, I'm assuming that you're all saving it for the 30th reunion. I hope so, as I'd like to glean several columns worth of news from our gathering in June.

Carnegie-Mellon University, on the recommendation of its university professors, has appointed **Ron Rohrer** University Professor of Electrical and Computer Engineering. This title is the highest honor Carnegie-Mellon can bestow on a faculty member. The appointment recognizes Ron's achievements "in a variety of research and development, marketing, and management positions in the electronic design automation industry." Ron is a fellow of IEEE, and the founding editor of IEEE's *Transactions in Computer-Aided Design of Integrated Circuits and Systems*. He was also recently elected to the National Academy of Engineering, which cited his "creative contributions to simulation strategies for computer-aided design and for leadership in electrical engineering education." Our sincerest congratulations, Ron.

I also received word that **Warren Van Genderen** has been appointed CEO and president of the Patten Corp. in Stamford, Vt.

That's all the news for this issue; but before I close, I would like to remind those of you who have not yet contributed to this year's Alumni Fund (or those of you who have not figured out what to do with that big tax refund) to help Tech and our class project. The fund year ends on June 30, so you still have time.—**Frank A. Taparo**, secretary and class agent, 15 S. Montague St., Arlington, VA 22204

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Pete Buttner writes, "It's unlikely I will ever match the business and professional accomplishments of our classmates who routinely write in." He says he is presently self-unemployed but is looking for consulting work. He has been rejected by some of the best companies in the world. Luckily, the Buttners live in West Brattleboro, Vt., where the cost of living is reasonable. On the up side of the ledger is Pete's full recovery from tongue cancer, his son Karl's (MIT '87) success at Delphi Technologies (a database company), and daughter Lisa's contentment at Brown. Apparently Lisa rejected an offer from MIT and is most content in the Ivy League.

Leo Heiblinger writes, "We are settling in Hong Kong. It's my third year of expatriate posting for Sandvik Co. Every month I spend two weeks in China. Sometimes I travel to the real boondocks even for the Beijing Chinese! My son is in his first year at Middlesex School in Concord, Mass. It's his first chance at being

Americanized after schools in Taiwan, Japan, and Korea. Hong Kong is great—dynamic, modern, and forward looking. China, in turn, is like a yoyo. Change is lateral, first forward, then backwards again."

Curt Shambaugh was named director of CS First Boston, Inc., taxable income division. He says, "I have been strategist for the last seven years at First Boston after having been portfolio manager of fixed income and equity accounts for Alliance Capital Management and predecessor organizations for the prior 22 years. My daughter Lisa just graduated from Princeton and my son Jay is a sophomore at Yale."

Feeling mature? So does **John Ritter**, who says he just turned 50 and that two of his four kids are in graduate school and *self supporting*! He says he still very much enjoys teaching and research at UMass. "I am still active in competitive sports (tennis, squash, and running). With our last two kids in college, Barbara and I are looking forward to our empty nest as we approach our 30th anniversary. Our only worry is trying to survive the 'Massachusetts Miracle' and its impact on the University."

Over the Christmas holidays I took a wonderful vacation in India. It was the trip of a lifetime. India is a marvelous country with friendly people, amazing animals, fascinating culture, and beautiful monuments. In preparation, I wrote to some of our classmates living there. They were all very helpful. Most of them were taking vacations and were away, but I was able to get together with **Aditya Nehru**, Course II. He is one of the most pleasant people imaginable. We met in New Delhi, where he works for Sandoz. Among other things, he said that he would be very optimistic about the future of the country but for the growth in population. After a month visiting all corners of India, I agreed. It is a vibrant nation with all indicators showing rapid progress. India has an agricultural surplus, exports manufactured goods, such as cars, and has vast resources. Now if the population could be controlled. I look forward to returning on a regular basis.

Here are some other recent honors to classmates: **John Scanlon**, who lives in Beverly, Mass., is now on the Endicott College board of trustees. John is the head of Scanlon and Associates, a management consulting firm. . . . **Michael Mack** just became vice-president of engineering at Ion Technology Division of Genus, Inc., in Newburyport, Mass.—**Andrew Braun**, secretary, 464 Heath St., Chestnut Hill, MA 02167

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Robert E. Wilhelm has been elected senior vice-president of Exxon Corp. Bob was executive vice-president of Exxon Co. International, Florham Park, N.J., prior to his recent promotion. He joined Exxon in 1963 after receiving an MBA from Harvard, and has held positions in both the domestic and international operations of Esso and Exxon for the past 27 years. His assignments have taken him to Houston, New York, Bogota and Cartagena, Colombia, Baltimore, London, and more recently to Coral Gables, Fla., where he was president and director of Esso Inter-America, responsible for coal, oil, and gas operations in the Caribbean and Central and South America. Bob is a member and vice-chairman of the Council of the Americas, the business arm of the Americas Society, and holds memberships in the Queen's Club (London) and the Harvard Club of New York. Bob writes that since Exxon is moving its corporate headquarters to Dallas, he will be relocating once again with his family this summer.

Dave Stare, our friendly Dry Creek Vineyards vintner, writes that he has just returned from a two-week tour of the Australian wine country. During his trip, sponsored by a group of Australian vintners, he lectured at Charles Stuart University. Dave says this is the first time someone else has picked up the tab for his many trav-

els. This is especially significant since Bonnie Prince Charlie, like most Highlanders, was not known to be easily parted with money.

Kenneth Klivington has recently published *The Science of Mind*, MIT Press, 1989. He has gathered together into one volume some of the best articles dealing with mental activity and brain function, with interesting commentary on sleep and dreams, mental disorders and drug addiction, as well as descriptions of new discoveries in neuroscience research. There are also discussions of how the brain develops from conception to maturity and how it degenerates as we age. Ken received a PhD at Yale after graduating from MIT, and was one of the early members of the Neurosciences Department at the University of California, San Diego. At the Alfred P. Sloan Foundation in New York, Ken established and directed programs in neuroscience and cognitive science. He currently serves as assistant to the president in Scientific Planning at the Salk Institute for Biological Studies in San Diego.

Phil Nelson writes from Arvada, Colo. that his sons are both enrolled as undergraduates at Brown, one concentrating in biology, the other in mechanical engineering. Phil's daughter, Hanna, age 2, helps keep Phil aware of the early phases of human development. . . . **Mitch Maidique** brings us tales from Miami that only the president of Florida International University would tell. FIU has nearly 20,000 students and was ranked sixth in its category by *U.S. News & World Report's* "Best Colleges" edition of October 1989. FIU is categorized as a "comprehensive university." In January 1990, Florida International inaugurated its new \$15 million engineering building with MIT President Paul Gray, the keynote speaker at the dedication. After a spectacular success running various electronics companies, Mitch seems to be doing quite an encore as president of FIU.

Richard Garber wants to know if any classmates have had experience in preventing tourists from taking over a quiet, peaceful community. It seems that he and his neighbors in Hood River are having major problems with the influx of wind surfers. Anyone who knows how to handle the peaceful displacement of invading tourists may contact Richard through this column. Any suggestions will be published after consideration of potential legal and moral consequences. I imagine the NRA might have some suggestions compatible with the Second Amendment, but then I'm not sure how we handle things like the "moral equivalent of war." . . . **Art Funkhouser**, our expert on dream interpretation and Jungian psychotherapy, writes from Bern, Switzerland, that he will be co-therapist at a new counseling center in Thun (32 kilometers or 20 miles south of Bern). Funky is setting up a private practice there as well as continuing his practice in Bern for a while. He gave a talk to the MIT Club in spring 1989 that was well received—if any of those attending were members of the class of 1962, they might have experienced a sense of déjà vu.

Peter Maas, professor in the Department of Physics & Applied Physics at Strathclyde University in Glasgow, Scotland, writes that he is starting a new research focus by joining the superconducting devices group at Strathclyde, and working with clinical biomagnetism research at the neurophysiology group at Glasgow Southern General Hospital. Pete says that it's a chance to combine his two favorite areas—solid-state physics and biological physics. "New research is like a new job," according to our superconducting personal magnetism expert in Scotland. We always knew Pete had the ability to develop a "magnetic" personality. Now if we can patent the invention and market the product, we will be able to endow a professorship at MIT.

George W. Meyer writes that he is now living in West Germany as commander of the U.S. Air Force Clinic in Ramstein. His son Robert is a junior at the University of California, Davis; daughter Liz is a freshman at Tulane in New

Orleans. George recently returned from Oslo, where he visited with Henrik Wessel and Brent Aasnaes (MIT, '64) and their families.

Your letters and notes were more numerous than usual this month, probably a manifestation of the holiday spirit. It's always more fun to write the column when we have lots of input, so keep those cards and letters coming (preferably with increased donations to the MIT Alumni Fund to match the **David H. Koch Challenge**). Also drop me a line if you get the chance.—**Hank McCarl**, secretary, P.O. Box 352, Birmingham, AL 35201-0352

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When we left our story in the April issue, Barbara and **Mike Bertin** had just completed their 'round-the-world trip, with visits to Istanbul, Rhodes, Crete, and Athens. Upon returning, they celebrated their 25th anniversary. The June 1989 party in New Jersey included Jan and **Jack Solomon**, Margie and **Larry Krakauer**, Sue and **Frank Model**, Carole and **Pete Van Aken**, **Ira Blumenthal** and **Andrea** and **Martin Schrage**. In October the Bertins spent a weekend in Boston with their daughters—Laura, a Harvard senior in applied math, and Amy (MIT, '87), a graduate student in economics. Saturday night included dinner with Laura and Amy, Gerald Cohen ('88), **Ira Blumenthal** and his daughter Robin, and Sue and **Frank Model** with their daughter Karen, a classmate of Amy's.

Mike Chessman reported from Portola Valley, Calif. on the San Francisco peninsula, where he's lived 12 years—the past three as manager of manufacturing engineering at Varian Associates. One daughter is a junior in history at the University of Wise (Where is that, Mike?) and the other is an eighth grader. The big earthquake did only emotional damage and was "no fun at all."

Margaret Hickey recently became full professor at Mass College of Art, where she is head of environmental design—including architecture, industrial design, and computer graphics. She recently had an exhibition of her algorithmic computer color graphics at Ball State University in Indiana. . . . **Jerry Miller** is an attorney with the D.C. firm of Miller and Fields, living in nearby Potomac, Md. He deals in FCC law, but—get this—in late December he started his own FM station in East Porterville, Calif. Good luck, Jerry!

Also living in my home state of Maryland is **John Flaherty**, who with his wife Lois has just built a new house on the water at Arnold, near Annapolis. Their sons are off at college: Keith is a Yale freshman and Mack is a Princeton senior. John himself, an MD, is at the Hopkins Med School, teaching and doing research in cardiology using NMR, EPR, etc., which makes his days at Tech seem especially worthwhile.

Elliott Bird reports his "running came to an abrupt halt in October when a bronchitis-like cold/cough was diagnosed as asthma (at age 48!)" He spent three weeks at Christmastime in Hawaii, presumably for therapeutic reasons. He asks **Ron Cheek** why he wasn't at our 25th reunion, and where he is now.

Elizabeth O'Neil lives in Lexington, Mass. but that is all I know. . . . Also in Massachusetts is **Ralph Grabowski**, who continues his success as a consultant in sales and marketing of high-tech products. In January at the MIT Enterprise Forum in Cambridge he gave a talk called "Becton Dickinson Medical Systems—A Marketing Turnaround Case Study."

Speaking of consulting, my software-training firm is getting off the ground, literally. One of my clients, which produces a specialized CAD program for the sewn-goods industries, sent me to train its new dealers: last summer in Manchester, England, and this February in Caracas, Venezuela. When Linda and I chose the company name Training To Go, we had no idea.

Keep those letters and phone calls full of news coming, please.—**Phil Marcus**, secretary, 3410

Orange Grove Ct., Ellicott City, MD 21043, (301) 750-0184

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I regret to start this column with sad news concerning the deaths of two of our classmates. According to information recently reported to MIT, **Alexander "Jerry" Borrevik** died on September 23, 1982. No further details are available at this time. . . . **Frank Darmory** passed away December 7, 1989. He was employed by Alcide Corp. in Norwalk, Conn. and lived in Westfield, N.J. . . . On behalf of the class, I extend condolences to the families and friends of these classmates. If any of you have further information about Jerry or Frank, please send it to me.

There are just a few Alumni Fund notes to report this month. **Lawrence Kaldeck** writes that he is still "hanging in" at Northrop Precision Products Division in Norwood, Mass., even in the face of an increasingly constrained government budget. On a more upbeat note is the bar mitzvah of his son, celebrated in April 1989.

Michael Stulberg, M.D., was recently made director of the Clinical Chest Service and Cystic Fibrosis Program at University of California/San Francisco. Mike writes that he found our 25th reunion far more touching than he had expected. It turned out that 15 of his 17 AEPi brothers attended. Just guessing, but that has to be about the best living group turnout percentage of any. Can anyone top it?

Len Parsons continues as marketing professor at Georgia Tech. He spent the fall as visiting professor at the Norwegian School of Marketing in Oslo. While in Europe, he got together with **Pete Angevine** in Stockholm one weekend. Pete has joined the American subsidiary of Hedemora, a Swedish company and has relocated to the Atlanta area. Len's professional activities are many: he is on the Research and Test Development Committee of the non-profit organization that "owns" the dreaded GMAT (Graduate Management Admission Test); he recently co-authored two books, *Market Response Models: Econometric and Time Series Analysis* and *Marketing Management Text and Cases* and will be a visiting professor at UCLA through August. Whew!

Well, it's time to stare out the window and take a look at the beauty of a late January snowfall up here in Vermont. Please send some news.—**Joe Kasper**, secretary, RR2, Box 4, Norwich, VT 05055

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25th Reunion

Counting down to the reunion. We should be pretty close by the time you read this. . . . **Ron Newbower** starts the month's news with a note that he was appointed vice-president for Research and Technology Affairs at the Massachusetts General Hospital as of February 1. Ron and wife Donna (BS, MBA, Simmons) live in a newly-built passive solar house in Acton, Mass., that is intended to make the New England winters more friendly. The Newbowers have two sons, in junior high and high school. . . . **Christopher Ebbe** says that there was some excitement in mental health in California last year. He was able to help in the Red Cross shelter the day of the jet fuel explosion in San Bernadino in May, and in November was involved in debriefing staff who volunteered to help in the Santa Cruz area following the big earthquake. . . . **Stephen Deutsch** says he's busy with an active legal practice at Foley, Hoag and Eliot in Boston, an older daughter off at college, and a baby toddling around. He says he found himself involved in some major computer litigation with Don Joseph '62, and was glad they were both on the same side.

Rick Armstrong sent both a letter and a flyer for his campaign for the Republican nomination for lieutenant governor of Massachusetts. Rick and Ted Davis, '66 had owned and operated a boat yard on Cape Cod through the mid- and

late-seventies, then Rick returned to the Institute in 1978 as associate director of Admissions. When Ted left the boat yard in 1980, Rick went back to the Cape as owner-operator of the business, which he sold about two years ago. While operating the boat yard, Rick also found time for involvement in local and regional politics on the Cape and says that the "chaos and frustration" of the Massachusetts political scene as seen from local government caused him to decide to run for statewide office. Rick says he plans to be at the reunion but doesn't know when or for how long!

December brings the annual Christmas letter from Suzy and Greg Schaffer. Greg is now one of four engineering directors at Maxim Integrated Products, a new (400 employees) manufacturer of integrated circuits. The Schaffers also moved from their condominium to a new house in Cupertino. Greg's new sport of the year is downhill skiing. He managed to reach intermediate level without getting injured and has also tried some cross-country. Greg has also taken up jazzercise and singing and continues his rock climbing and riding. He writes that he enjoyed the earthquake and won the men's sexiest costume award at Maxim's Halloween party. Greg also says that a hamstring muscle problem seems to keep his running time slower than 6-1/2 minutes per mile.

See you soon. Looking forward to our 25th.—**Steve Lipner**, secretary, 6 Midland Rd., Wellesley, MA 02181

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I received a nice long letter from **Henry T. Goldman**, summarizing his activities. He attended the Sloan School and Georgetown University Law Center after graduation from MIT. His first case, as a new lawyer in Washington, D.C., was helping to represent one of the Watergate defendants. For 13 years he has been with Warner & Stackpole, in Boston, specializing in labor law. Henry has been married for 15 years and has a 13-year-old daughter and a 9-year-old son.

Michael Oppenheimer has written *Dead Heat, The Race Against the Greenhouse Effect*, which should see publication by April (1990). Michael directs the Environmental Defense Fund's global atmosphere program. . . . **Tom McDonough's** new novel has been delayed until 1991. . . . **Ed Tsoi** is still one of the principals of Tsoi/Kobus & Associates. He is married, with two daughters, 15 and 18.

Last July, **Michael Kinkead** resigned from Saddlebrook Corp., shortly before the company closed. He is in the process of starting a new venture. . . . **Howard A. Smith** was recently appointed chairman of the new Astrophysics Department at the Smithsonian Institution Air and Space Museum in Washington.

Believe it or not, our 25th reunion (the big one) is only one year away. A planning committee has already been formed. Put the date on your calendar—you won't want to miss this one.—**Jeff Kenton**, secretary, 7 Hill Top Rd., Weston, MA 02193

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Roy Gamse is vice-president of marketing for MCI's mid-Atlantic division, where he is in charge of residential sales, customer service, sales to other long distance carriers, and product marketing. . . . **Robert Sitrin** is director of biochemical process research and development at Merck, Sharp, and Dohme Research Labs, where he is responsible for purification process development for vaccines and recombinant proteins. . . .

Michael Zutek served on the organizing committee for the 1989 Tornado World Championships held in October at the Houston Yacht Club. Tornado is the Olympic catamaran, and Michael participated in a prime time television special where he discussed the boat and its history. Out of 17

U.S. entries Michael's was third highest. Michael is also a volunteer for a committee on materials research for wind turbine rotors supporting the National Research Council/National Academy of Sciences.

Rich Feiertag and Laurie proudly announce the birth of their second son, Russell Jared, in September 1989. . . . **Bill Lange** has been elected president and chief executive officer of Pan Am Express, a subsidiary of Pan Am Corp. that provides connecting domestic and intra-European feed traffic to Pan American World Airways' international and U.S. operations. Bill's daughter Beth is in her second year at Penn State Medical School, and his son Bill is a junior at Bowdoin College.—**Jim Swanson**, secretary, 878 Hoffman Terr., Los Altos, CA 94024

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Please send news to your class secretary.—**Gail and Mike Marcus**, secretaries, 8026 Cypress Grove Ln., Cabin John, MD 20818

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Alan R. Millner is principal scientist at Abiomed, Inc., in Danvers, Mass. where he is project director of an effort to develop a fully artificial heart. Alan is also active in helping Soviet "Refuseniks" find jobs in the Boston area. . . . Alas, no other news to report this month, other than the extensive coverage the *New York Times* gave in January to **Robert A. Swanson's** company, Genentech, about its financial condition, management intrigues, and sale to a foreign concern. . . . And we've just learned that the new MIT president come July will be Professor Phillip A. Sharp, the first biologist to become an MIT president—and the second MIT president to have a full beard like us '60s kids! He was born on D-Day, June 6, 1944, so you might say he's a man roughly of our generation—another first.—**Eugene F. Mallove**, secretary, 171 Woodhill-Hooksett Rd., Bow, NH 03304

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20th Reunion

Bob Bowden is currently general manager for one of Hewlett-Packard's Palo Alto operations and also serves on the MIT Alumni/ae Association's board of directors. . . . **Alfred Langguth** recently became R&D manager for the Intensive Care Business Unit of Hewlett-Packard in Waltham, Mass., and has almost finished building a Victorian home in Hudson, N.H. . . . **Howard Bluestein**, associate professor of English at the University of Oklahoma, married Kathleen Welch (June 1989), and they honeymooned in Cancun. **Bob Dennis** was his best man. They spent most of the summer at the National Center for Atmospheric Research in Boulder, Colo., and in Europe. Howard was selected Oklahoma Professor of the Year.

Anthony M. Rufolo co-authored *Public Finance and Expenditure in a Federal System*, to be published by Harcourt Brace Jovanovich in 1990. . . . **Christopher M. Rose** writes to say he enjoyed visits with **Alan Chapman**, professor of music at Occidental College, and **Jeff Weisel**, an internist. Jeff is working with his partners at the Valley Radiotherapy Associates to build a new radiation oncology center in the west San Fernando Valley. . . . **Stanley Bone** was promoted to associate clinical professor of psychiatry at Columbia University College of Physicians and Surgeons and continues to live in Manhattan with his wife, Maureen, and their two children.

Frederick J. Endicott lives in San Carlos, Calif., and is guaranteed that any letter he writes to the undersigned will be placed in the column. . . . **Ted Goranson** is now supporting DARPA in long-range planning for Sematech. His son, Jesse, is now a sophomore at MIT. . . . **Janet Mertz** is

presently a tenured associate professor of oncology at the University of Wisconsin, Madison. She and her spouse are trying to raise two young sons, Daniel and Jeremy, while holding down full-time academic jobs. She is presently interested in any leads for good nannies who would like to live in Madison.

Fred P. Davidson and his spouse, Maida, had their third child, Michael, in November. Fred is developing software testing tools at Bellcore in Piscataway, N.J., and enjoying UNIX after many years of IBM. . . . **Sandra L. Wilcox-Riggs** is assistant chief of anesthesia service at Madigan Army Medical Center and is a lieutenant colonel in the Army. Her spouse is a dentist in their hometown of Tacoma, and their two children are doing well. She indicates that they hope to remain in the Tacoma area, although their family is still near Boston. . . . **Frank D. Bender** has been in pulmonary-critical care practice at Palomar Medical Center since 1981. He is medical director of Respiratory Therapy. He and his spouse are expecting their second child in March. . . . **Stephen D. Cohen** has recently been promoted to vice-president of marketing and sales of Trumpf, Inc., in Farmington, after having been marketing manager at Hewlett-Packard in Andover.—**Robert Vegeler**, secretary, Beers, Mallers, Backs, Salin & Larmore, 1100 Ft. Wayne Natl. Bank Bldg., Ft. Wayne, IN 46802

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Philip C. Abbott, a Purdue University professor of agriculture economics, has won the 1989 Agricultural Research Award of Purdue University. This award is given in recognition of outstanding research by a faculty member in the School of Agriculture with less than 15 years' experience. Philip's specialty is the interplay between U.S. economic policy and agricultural trade. Philip earned bachelor's, master's and doctoral degrees in mechanical engineering and economics from MIT. He joined the Purdue faculty in 1981 as an associate professor of agricultural economics. . . . **Daniel Weinberg** has remarried and increased his family to five children. He is the chief of the Housing and Household Economic Statistics Division of the Census, and his wife, Susan, is secretary to the senior partner at a patent law firm in Alexandria where they reside. . . . **Nancy Lieberman Rosenfield** lives in Lexington with her husband Don, '69, and three children, Jennifer (15), Todd (11), and Adam (3). She left her software engineering job at Data Resources last summer, enjoyed a few months of well-earned leisure, and is now actively seeking a new software engineering position in the Boston area.

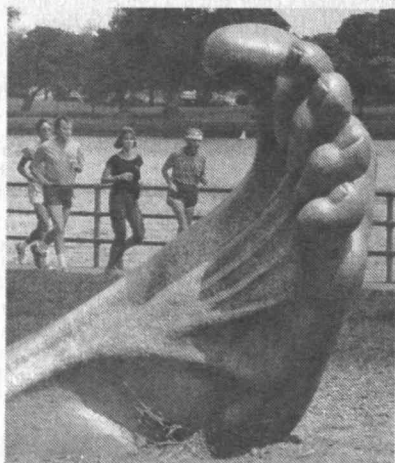
Kevin McEntee now has two daughters, Anna (5), in kindergarten and loving it, and Alyssa, born on August 30, 1989. . . . **Dale R. Geiger** is back for the doctoral program at the Harvard Business School and lives in Belmont. . . . **Edward M. Donie** recently authored 1-2-3 *Business Applications* published by QUE Corp. In addition to his consulting activities, he is working on co-authoring a book, *Decision Support Systems and Financial Management*.

John Calcagni writes: "Had a very interesting year at EPA as director of the Air Quality Management Division. I worked on drafting the President's Clean Air Act bill and subsequently am involved in efforts to have it enacted. I also worked at revitalizing a number of programs which had become moribund over the past eight years. Doing my best to make George Bush the environmental president. (Earth Day's 20th anniversary is April 22, 1989.)

Randolph M. Gregg was selected to the Motorola Semiconductor Sector Technical Ladder and named senior staff engineer in 1989. He has two daughters, 1 and 3 years. His wife Abbie, '74, is still traveling around the U.S. consulting on semiconductor FAB Technology. . . . **Joseph Angland** is a partner in Dewey, Ballantine, Bushby, Palmer & Wood, a New York law firm. Among other

Oops!

Our apologies for a printing error, making the caption below illegible in our February/March 1990 issue (p. MIT 30).



President Bush jogs in Washington Park with Norm Sandler, '75 (White House correspondent for UPI), Rita Beamish, and personal friend Vic Gold. The huge foot in the foreground is part of the giant sculpture "The Awakening." Thanks to Lee Giguere, '73, layout chief at the Journal Inquirer, Manchester, Conn., for bringing this photo to our attention.

schein, Carlin, Nath & Rosenthal. Norman is president of the local Jewish day school as a result of speaking up when he should have kept quiet.

Kathy Swartz (her husband is Frank Levy, '63) are visiting faculty at the Taubman Center for Public Policy at Brown University this year. They and their two children (David, 11, and Marin, 8) are enjoying being in Providence. Kathy is teaching a class on health policy problems and is continuing her research on people without health insurance. . . . **Joshua Goldman** is working in the documentation group at the Open Software Foundation. Melanie, his oldest, is applying to colleges (after having attended their graduation in a stroller). How those years fly by! Arielle will be 7 soon and Evan 4. He and his wife, Marcie Land, manage to contradance in their spare moments.

More recent updates reveal that **Kathy Kram** continues enjoying her 3-year-old son, Jason, along with her teaching and research at BU. Kathy and her husband have been studying ethics in corporate life. This is an outgrowth of her studies of career issues. Her husband is working at the Kennedy School this year on a one-year project on ethics, where he will continue his work on corporate ethics. . . . **Carliss Baldwin**, now faculty at Harvard Business School, had her second child, a son, last June. Currently, she has been teaching doctoral students at Harvard. Husband Randy Hawthorne, '71, continues to do real estate development work all over the country, as best I can tell. He has found a good niche in low-income housing.

Last spring I got up to Cambridge, and saw **Richard Weissburg**, who had recently switched over to working for Lotus. The new job sounds interesting, but one-and-a-half years after his return from a year traveling the world, Richard and Barbara still hunger for more travel. I had the opportunity to see some slides from their trip while I was recently in Cambridge. I also saw **Bonnie Kellermann**, **Carliss Baldwin** (and Randy), and **Kathy Dram** and her husband, Peter. All were doing great.

Rumor had it that **Dave Krackhardt** is excelling in his field, working and teaching at Cornell, in the management behavior sciences area. I must admit that, although I heard that he has tenure, I do not know his exact area. This news came out as I reminisced last spring with T.J. Allen, '76, about the project we had done as part of a larger group for his class 19 years ago (already!).

By the time you read this, I hope you have had a great spring. Both **Dick Fletcher** and I want you to send more notes to us.—**Wendy Elaine Erb**, co-secretary, 6001 Pelican Bay Blvd., Apt. 1003, Naples, FL 33963, **Dick Fletcher**, co-secretary, 135 West St., Braintree, MA 02184

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From the top. . . . **Ernest Hall** received the prestigious Coolidge Fellowship Award from GE's R&D Center for his leadership in the field of electron microscopy and its application to problems in materials. He will be given a year's leave to "follow individual pursuits." . . . **Drew Bottaro** has become a tax manager with Deloitte and Touche in Boston. . . . **Lee Perrin** is (still) director of obstetric anesthesia at St. Elizabeth's, also in Boston. He will be leading a group of anesthesiologists to the Soviet Union for joint conference.

Michael Druke is still designing computers at Rational in Silicon Valley. His first child, Laurel, was born in September. . . . **John Mack** received the President's Award from Blacks in Government for his work in computerizing the MIS of their national office. . . . **Michael Cheng** has moved to Stamford, Conn., with his wife and Jason ('08) and Katherine ('11).

John Chandler is in Winchester, Mass., bemoaning the sudden demise of the MIT Choral Society. He, too, counts Soviet travel in his

report, attending an IAU symposium in Leningrad in October. . . . **Russell Dominique** is "working too many hours" as the hardware division manager at Radix Systems. . . . **David Moylan** recently co-authored a chapter on hypothermia in a medical textbook, *Therapeutic Radiology*. . . . **Glenn Sharfin** is still an orthopedic surgeon, trying to do a lot more fishing near his south Florida home.

We're comfortably surviving the cold December and mild January here, so live on our day with a letter!—**Robert M.O. Sutton, Sr.**, secretary, "Chapel Hill", 1302 Churchill Ct., Marshall, VA 22115

74

One of the nice things your faithful scribe has come to rely on over the years is regular, dependable updates on the progress of **Paul Schindler**. Paul has left *PC Week* for greener pastures, returning for the second time to *Information Week* where he is, once again, senior editor. Why don't the rest of you write as often as Paul, or **Dave Withee** or **Marc Lauritsen**? (And how many times do I have to tell you to clean up your room?)

Wanna hear about an exciting job? "In 1990, I will be leaving American Nevada Corp. to become more involved with resort and casino development in Las Vegas," writes **Bruce Barton**. "After five years of developing office buildings, shopping centers, athletic clubs and office/warehouse complexes in Henderson, Nev., it's time to move on." . . . **Martha** and **Albert Lazzarini** have been living in Colorado Springs since 1984. They have three sons: Allesandro, Christian, and Thomas. Albert has been working on a space shuttle-based optical experiment at Kaman Aerospace Corp. . . . Happy news from **Winnie** and **Jeffrey Ng**, the proud parents of Thaddeus Alexander, 6 lbs., 10 oz. at birth 18 months ago.

"When Thaddeus is not occupying his parents' time, Jeffrey is a practicing architect and Winnie is a professor of computer science." . . . Received a nice long handwritten note from **Paul Chernick**. In 1986, Paul founded PLC, Inc., which now employs seven people. PLC provides consulting service in energy, regulation, and conservation programs for electric utilities and in quantifying and valuing the environmental effects of energy production. Pardon the pun, but that's one hot area of endeavor. Paul married Gila Appleby two years ago, and they share the caring and affection of twin girls. "We are busy, but very happy."

The folks in the class of '75 (next door) would like all you locals to know that you are cordially invited to join them at their Gala Night at Children's Museum during their reunion, June 9. Call the Alumni/ae Association at (617) 253-8230 for further info. The evening will include dinner, dancing, and a casino.

Marc Lauritsen has a year old daughter, Mary. He's been traveling to Europe, delivering papers on "Representing Legal Knowledge in Computer-Based Practice Systems" in Florence and Salzburg over the winter.

Gary Raymond married Elaine Cerkez this past August. They honeymooned in Montreal and Quebec City, bought a house in Riverside, Ill., and are "trying to decide when to hold our first garage ssale." Gary's traveling less but still puts in 12 weeks a year on the road. He recently returned from England, "where our newest software products were given a very good reception."

The Correspondent of the Month award, for the note with the nicest quote (or funniest, or juiciest, depending on the mood of your faithful scribe) goes to **Kelly Redmond**, and thanks for the note. Kelly earned his PhD in meteorology in Madison, Wis., "having a good time to boot." Then followed seven years as state climatologist for Oregon. That's where people don't tan in the summer, they rust. Just about a year ago, Kelly became the regional climatologist at the Western Regional Climate Center in Reno, Nev. He is also

things, he is serving as anti-trust counsel to Sematech & U.S. Memories. . . . **R. Dale Zellers** will be moving from Parker, Colo., to somewhere around Boulder since two divisions of Ohmeda are merging. . . . **Nancy R. Burstein** has been working at Abt Associates in Cambridge for ten years as a senior analyst. She is president of the New England Gilbert & Sullivan Society. Her daughter Rebecca (11) plays the violin, and her son Richard (8) is clearly MIT material. . . . I have been board certified in estate planning and probate law by the Texas Board of Legal Specialization.—**R. Hal Mootman**, secretary, P.O. Box 1808, Brenham, TX 77833

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Hi! I'm glad to have news to report this month. **Nagasato Uchida** got leukemia in 1987 and had a bone marrow transplant operation August 21, 1987. His older brother luckily had similar HLA chromosome and was able to be the bone marrow donor. As a consequence of the operation, his blood type changed from "A" to "O." After being hospitalized for over one year, Nagasato was cured and able to return to normal living conditions. He is happy to advise people in similar situations and can be reached at: 404, 3-12-30 Shirogane-dai, Minato-ku, Tokyo, Japan. . . . **Norman V. Kohn** is still practicing neurology in Chicago, and you can tell because I could not read all of the news he wrote. He traded something but I cannot read what. However, Lisa left GTE to return to law firm practice at Sonnen-

president of the American Association of State Climatologists. "During all this I have somehow managed to remain single. My sense of humor was surgically removed during a recent lobotomy."

Write and tell me your vacation plans! And don't forget to send a postcard when you get there!—**Lionel Goulet**, secretary, 115 Albemarle Rd., Waltham, MA 02154-8133, (617) 899-9694

75 15th Reunion

We have quite a bit of news this time! Here it is, in no particular order. . . . **Karen Midthun** is married to Bob Brooks, '74, and they have two sons. They are living in the country on a farm in Sharpsburg, Md. Bob practices orthopedic surgery in nearby Hagerstown. Karen is an infectious disease specialist and has a primary interest in vaccine development. She works at Johns Hopkins University in Baltimore. . . . **Alan B. Lefkoff** was promoted to president of Grid Systems Corp. as of January 1, 1990. His daughter, Katherine Louise, was born on May 31, 1989, and his son Drew turned 3 years old last December. Wife, Ann Gordon, has taken a leave of absence from ERA for a tougher job—chasing the kids. . . . **Thomas Olsen** writes, "The last year and a-half have been quite eventful. My wife, Debbie, and I had a son, Tim, in June 1988. I was granted tenure at Lewis and Clark College last spring, and our daughter, Janet, started kindergarten this fall."

Joseph Sorge is CEO of Stratagene, a biotechnology company located in LaJolla. He and wife Marianne have two children, Kristina (3) and Andrew (1). . . . **Russ Phillips** is an assistant professor of medicine at Beth Israel Hospital and Harvard Medical School in the Division of General Medicine and Clinical Epidemiology. He and wife Elise have three children: Zeke (6), Jeremy (3), and Adam, (2). . . . **Elliot Feit** recently became engaged to Claudine Cohen (Cornell, '85). An August 1990 wedding is planned. Elliot works at IBM, Poughkeepsie, N.Y., in operating system performance, and is a part-time professor at Marist College. . . . **Paul F. Benton** is currently practicing in San Diego, having just completed a seawall with dissipative features for sand retention.

B. Anthony Isaac has been in Kansas for five years. His fourth son, Gerald, was born last June. Tony is president of a start-up hotel company, Summerfield Suites Hotel Corp. They have three hotels open and eight under construction. Says Tony, "Entrepreneurship is hard work, but rewarding." . . . **Mike Kozinetz** writes, "Our stay in Beaver Valley was cut short, but Michelle and I are now in the Northeast—West Suffield, Conn. I will be working on the construction management team of a manufacturing/waste treatment facility in the area, and we're scheduled to be here about two years. Michelle hopes to explore in and around New England during that time. I'm just trying to cope with the overcrowded and hectic rushing around here!"

I received a wonderful letter from **Kenneth Johnson** and I reproduce it here in full so that you all can enjoy the humorous recount of his life beyond the Institute. . . . "When I last left off, I had planned to exit the Stanford Operations Research doctoral program for a similar program in transportation at Berkeley. Due to residency rules that eliminated my transferring any time-as-graduate-tool, I chose to sit and think. In the meantime, I met some fine rock-and-rollers at Stanford. We formed a band called Wildebeest, played all over the San Francisco Bay, recorded an album called "Reckless Dreams" at the Grateful Dead's Studio, Club Front, and then faded away. . . . like a dream. Meantime, I watched quarks at the Stanford Linear Accelerator Center to pay the rent until I made the big move back East, finally settling in northern Virginia in 1985, where I have done linear programming (yawn) and artificial intelligence study. I am currently en-

sconced at Stanford Telecommunications, where I try to apply neural networks to resource scheduling in communications networks by day and build a neural network that will play "Dark Star" in the nighttime.

"I have tried to train Macintoshes to play bass and drums for my next working band, but that is a work-in-progress. I have been a MacFan for years, as that fine machine was named Macintosh within months after I began broadcasting a radio program from Stanford out over the Cupertino air, under the nom d'aïre of MacKintosh, so I like to imagine that some Eno fans at Apple were listening some noon hour and decided that, yes, that's a fine name for an Apple.

"I continued to play in the Stanford Marching Band even when on my "sabbatical," leading to my being five yards away from the trombonist who got spiked in that famous Berkeley-Stanford football moment of 1982. Had I been holding my old alto sax rather than my new one, I might have made the news by spiking the sax on the Cal runner.

"I make occasional visits to the Tute—aagh! They've yipped up the Student Center. No more 24-hour library. (S)lobdell looks like a shopping mall eatery. The graffiti boards are gone from outside the Math Department. I guess I've reached the "I-remember-the-good-ole-days" phase of life. I hope that I renew a few acquaintances at the 15th, and we can hoist a few in the name of the memories. (By the way, anyone interested in honoring the 20th anniversary of the Grateful Dead on the Student Center steps, bring your axe, and we'll find a place to gig!)

As a parting reality sandwich, may those who knew them remember fondly two of my Phi Delta brothers who have passed on much too early in life: both **Brian Van Lierop** and **Mark Swift**, '70, touched on my life in important ways and fell to illnesses in the end of 1989. . . . See you in June! . . . That's it for now. See you at the 15th!—**Jennifer Gordon**, secretary, c/o Pennie & Edmonds, 1155 Avenue of the Americas, New York, NY 10036

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Finally, some news to report. Please, please write or fax news. We have about 880+ classmates, the vast majority of which, after 13.5 years, have still not sent word of their activities.

Burt Rubenstein has been appointed director of Technical Enhancements at Bull NH Information Systems. Bert was one of the founders of Index Technology Corp. and was one of the original designers of Excelsior, a popular computer-aided software program (CASE). . . . **Thomas Downey** is currently a product manager for multiprocessor computers at BBN Advanced Computers in Cambridge and having lots of fun in marketing. He says, "We're in the middle of a flurry of renovation activity on our 1899 Victorian Home." . . . **Gerald Thomas** writes from Australia: "Left McKinsey and Co. after eight years to start my own company in systems integration. Expecting first baby in March 1990. Looking for MIT graduates with interest in financial trading systems, distributed data base architectures, global communications, and computer security."

Robert Chen: "Have been teaching a course on environmental policy in the developing world, on top of my work at the World Hunger Program. Interest in the implications of global environmental changes has shot up, leading among other things to a proliferation of meetings, workshops, and seminars on many different aspects of the problem. I'm also gearing up for organizing our annual Hunger Research Briefing and Exchange, which will be held here at Brown in April 1990."

. . . **Evelyn Brody** is an attorney and advisor in the Office of Tax Policy at the U.S. Treasury Department. . . . **Robert Heuman**: "After a seven-year stint with a software startup, ending up as vice-president of engineering, I am now doing independent consulting. I'm currently working in

San Francisco on an X-Windows project for Wells Fargo Investment Advisors, an investment banking company." . . . **Todd Kushner** is working for IBM in their Artificial Intelligence Technology Center of the Systems Integration Division on automating computer operations in Gaithersburg, Md. . . . **David Maass**: "Still happily engaged running Advanced Composite Products, the company I started in 1981. Lisa and I are very busy raising our two sons, Eric and Evan."

Jim Banks: "Still working at Hewlett Packard as an R&D section manager in Cupertino, Calif. My wife and I are expecting our second child by the end of this year." . . . **Kenneth Davis**, MD remains in pediatric practice in Elizabeth, N.J. His son, Jack, will be 2 in December (1989), and number 2 is due in May. . . . **Stanley Knutson** is engaged to Linda Marks, a psychotherapist and the author of the book, *Living with Vision—Reclaiming the Power of the Heart*.

Cheryl Marceau has been promoted to director of human resources at Mitre Corp., Bedford, Mass. She was formerly the manager for employee relations. . . . **Richard Trubiano** was promoted to superintendent of the Clinton Wastewater Treatment Plant (a subsidiary of the Massachusetts Resources Authority). He was formerly a project manager for the Massachusetts Water Resources Authority.

As for your secretary, Rita and I have had a second child, Samuel Maximilian Simon Carp. The futures markets continue to have frequent queasy moments, with big moves in currencies, oil, bonds, coffee, sugar, and cocoa. The overall level of volatility remains quite high. I expect it to continue unabated through this decade. Since I operate a hedge brokerage, I expect to see more demand for hedging services over time.

On the voice recognition front, our first product, the voicebox, is slowly gaining commercial recognition. Due to the radical nature of this technology, progress is slower than I would like to see, especially when measured against the movement of futures markets. We will have completed the patent applications and be shipping our second voice recognition product, which I have named the Scribe. In its current configuration, it will, while running on an 80387 PC at 58 MHz (not 33 MHz), allow the user to dictate at 120 words per minute. Once we have an 80486 PC to try, we believe we will be able to furnish virtual speech recognition. It promises to be a very exciting period for us, fraught with opportunity. It will be very interesting to see how the major computer companies react to us as "upstarts." Hopefully, we will be able to shock at least one sufficiently to allow us to do a licensing deal.

Please send news. We do need it.—**Arthur J. Carp**, secretary, Stalco Futures, Inc., 254 West 35th St., 16th floor, New York, NY 10001, (212) 736-1960, Fax: (212) 736-3664

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Dear friends, I am pleased to be able to report to you the news from 10 classmates. Next issue, let's include YOU! **Paul Menard** continues as vice-president at PC/M Group, Inc., a firm which performed \$3 million in architecture and construction services in fiscal 1988-89. . . . **William S. Kaiser** and his wife had a baby girl, Lily, in July 1989. William is currently a general partner with Greylock, a venture capital firm in Boston. . . . **Debbie Stutman-Brickey** was expecting a baby in January; she says probably a girl. Deborah is an NSF-funded visiting professor in the Chemical Engineering Department at Ohio State University. . . . **Arlie Sterling** and his wife now have two sons; their second boy, David Albert, was born May 29, 1989.

Steven Bader is still working (toof) hard as owner of a large dental office in Peabody, Mass., but he still finds time for skiing. He finds his 1-year-old son Andrew loads of fun. . . . Another classmate in the Boston area is **Esther Horwich**, who has her own law practice. She plays bass

trombone with the Metropolitan Wind Symphony and ice skates with MIT Figure Skating Club. She hoped to do some scuba diving this winter—some place warm. . . . **Stephen A. Greene** was looking forward with lots of excitement to the birth of his first child expected in April. He and his wife Ellen (Clark '82) are enjoying living in Washington, D.C.

Jerry Morrison is working for Apple Computer, Inc., in Cupertino, Calif. He and his wife, Sheri, have a delightful son, Evan, who was born in September 1987. Jerry had a moving 34th birthday on October 17—during the earthquake! Luckily, he had no damage. . . . **Cynthia Koelker** is a mother of three. She works as a physician in Urgent Care Practice of HMO part-time in Akron, Ohio. She would especially like to hear from friends from German House and MIT Concert Band. . . . **Todd Glickman** was recently re-elected president of the Technology Broadcasting Corp., which is an MIT Corporation Committee that oversees WMBR Radio. Todd finds that "weather and business still mix well, keeping me as much in the air as on the ground. But I manage to get home every Sunday morning for my radio shift—where I forecast and broadcast on dozens of stations nationwide, including WRKO in Boston."

Joia, Kellen, and Brielle continue to keep Paul and me busy and amused. But I always have time to read your notes, so send them to **Ninamarie Maragioglio**, secretary, 8459 Yellow Leaf Ct., Springfield, VA 22153

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Our class appears to be quite prolific from all of the birth announcements that come to us this issue. Congratulations to all of the proud parents. Additional news about the parents is included when provided.

Al Chock and **Bonnie Mason**, '79, sent a birth announcement and picture of Alfred Mason Chock, who, Al writes, "was born on Pearl Harbor Day. . . . It was the most wonderful and peaceful feeling in the world as I held my son for the first time. I like being a Dad." Al, Bonnie, and Alfred are living in Newton, N.H. . . . **Milton Roy** and **Gloria Lara** are proud parents of a baby girl, **Katherine Rebecca**, born in mid-December. Milton has been with GM since leaving Harvard Business School in 1983. He recently joined GM's corporate financial staff. Milton has been busy as a volunteer for MIT, as he is a member of both the Alumni/ae Association's board of directors and the visiting committee for mechanical engineering. Milt also is involved in GM's recruiting efforts at the 'Tute. . . . **Larry Yablong** reports the birth of **Elisheva Miriam** in October. The newborn holds three nationalities: American, Canadian, and British, as she was born in Toronto, and the Yablons live in Chicago!

Wendy Wolfe and **Mike Anciaux**, '77, are new parents to **Emily Wolfe Anciaux**, born in December. Houses and IBM have been major themes in Mike and Wendy's lives together. They first met at IBM in San Jose and bought a house as investment partners, then were married a couple of years later. They were transferred to Westport, Conn., still both working for IBM. There, they undertook a major renovation. Upon completing that project, they were transferred to Los Angeles where they built a beautiful house from the ground up. They both still work for IBM, too. . . . **Kathy** and **Gene Allen** are the proud parents of **Katherine Elizabeth**, born in December. Gene left the National Institute of Flexible Manufacturing early last year and returned to Washington to start his own company, **Advanced Manufacturing Techniques**, the goal of which is to assist in the modernization of the nation's manufacturing base.

. . . **Karyn (Altman) Velazquez** gave birth to **Jeremy Joseph** in November. "I barely got to the hospital in time. After a two-day labor with Jason, three and a half hours was a pleasure (as pleasurable as childbirth can be). At eight weeks

of age, **Jeremy** embarked on his first voyage overseas. Ray and I and the kids with the MIT women's volleyball team (**Jeremy's** quite a spiker already) to Barbados. We (**Karyn** and the team) ran Special Olympics clinics, competed against two Barbados All Star teams, and had a wonderful time on the beach." **Karyn** and **Ray** and kids live in Somerville, Mass.

Cindy Husmann Berman gave birth to **Dana Michelle** in September. **Cindy** claims that **Dana** has proven to be a "nearly perfect baby." While **Dana** wasn't quite yet up to it, **Cindy's** other kids, **Kim** (5) and **Sean** (3), helped fill boxes for the Class of 1978 Care Package Project at MIT in December. **Cindy** and husband **Hal**, '76, have taken up curling, and **Cindy** describes the fascination the game holds: "Curling is a sport where we spend two hours freezing our rears off and ruining our groin muscles and then retire to the lounge where the winning team buys drinks for everyone." **Cindy** is now a senior consultant for **Arthur D. Little**, working on studies about photocarcinogenicity. **Hal** is now with **Cognition Corp.** The Berman's are living in Wayland, Mass.

. . . **Jill Kern** writes: "I'm still working for Digital Equipment's CIM Marketing group and living in Hudson, Mass. The big news is that I'm getting married next June to **John Faricelli**, also a Digital person living in Hudson!" . . . **Theresa (Costanza) Nolet** has been busy: "We moved to Danville, Ky., in July to take new positions (still with **Corning, Inc.**) and are really enjoying Kentucky. We are surrounded by beautiful rolling hills and horse, cattle, and tobacco farms. **Dan**, '77, is project manager for **Advanced Fusion Development**. I am supervisor of **Process Engineering** at our **Ophthalmic Plant** in **Harrodsburg** where we make photochromic lenses and sunglass lenses. **Catherine** (7) and **Andrea** (4) enjoy their new schools. We're excited about **Catherine's** participation in the 'Young Astronauts' chapter which provides early experiences in science. Both girls love to draw pictures and are very creative."

Gary Cote has been doing postdoctoral research on circadian rhythms at U-Conn. He says that he is "struggling with writing, teaching graduate-level courses, replicating experiments that don't want to replicate, and keeping my desktop clean—mostly." **Gary** is living in **Mansfield Center, Conn.** . . . **Paul Martin** writes from **Liverpool, N.Y.**, "My wife, **Bev Leesman**, and I bought a house this fall, which has been an education, a financial drain, and a great joy. **Bev** has been churning out watercolors like mad and now has her own studio (she accepts commissions). I am taking voice lessons and will be singing the **Verdi Requiem** this spring with the **Syracuse Symphony** and **Oratorio Society**." . . . **Jordin Kare** writes us for the first time: "I got my PhD in astrophysics from UC/Berkeley in 1984, hunting for supernovae with an automated telescope. (Remember **Nemesis**? That was our group.) Since '85, I've been with the **Special Projects Group** at **Lawrence Livermore National Labs**, mostly working on **Laser Propulsion—space flight for \$100/pound before 2001!** I bought a house in **Pleasanton, Calif.**, last spring, so I'll be here for a while."

Paul Edelman also fills us in on life after MIT. He received his PhD in psychology at **Harvard** in 1983, married his now doctor-wife **Julia** in 1986, became parent to **Abraham** in 1988, built a new passive solar house in 1989, and is working as an independent consultant on development of company-wide quality improvement processes. The Edelman's are living in **Middleboro, Mass.** . . . **Regina Murphy** and husband, **Mark Etzel**, are "living in **Madison, Wis.**, and are both professoring at the **University of Wisconsin**. We sold our condo in **Cambridge** and bought a 1891 Victorian house on the lake and with its own sailboat." **Regina** says that she has come to really like the Midwest where "the living is easier, and there's still plenty to do."

. . . **Sue Ann Hanson** was most thrilled by one Christmas gift: "I just received a pin from my 'Secret Santa'—it says 'NERD PRIDE,' surrounded by the full spelling of MIT! I love it!" (Her secret Santa is, perhaps,

another alumnus from our alma mater?!). **Sue** continues, "Life continues here in D.C. I might have a career change in 1990 to software development of engineering applications with a real software/data processing firm! However, **Charlie** and I (he's still my 'significant other') are looking into starting a holistic health retreat: exercise, nutrition, and self-meditation. (We, too, are getting away from the hassle of big city living!)"

Doug and Sharon (Pastoriza) King have three boys—**Alden**, **Jonathan**, and now **David** who was born in March of last year. **Doug** reports that he missed the nitty-gritty of designing machines and left **Bechtel** to join **RPC Industries**, which produces electron-beam machines. **Doug's** charge is to get the products, which cure inks and cross-link plastics, from R&D to commercial production. The technology will help reduce the use of toxic chemicals. **Doug** and **Sharon** are both very involved in their church's religious education programs. The Kings are living in **Berkeley, Calif.**

Your class secretary undertook a simple survey of classmates' work addresses to discern what our class of 946 (those with addresses) are doing professionally. The survey is decidedly incomplete: only about two-thirds of the class have business addresses. The breakdown is subject to some inaccuracy associated with the interpretation of some business titles or the presence of old business information. The results, nevertheless, seemed worthy of publication:

Of the 660 classmates with work information, it is probably no surprise to you that 190 of us are working in the computer industry (hardware and software). Ninety classmates are medical doctors in a wide range of specialties; 87 classmates are engineers (not including management); 44 are involved in education—almost all at the college level. Thirty-three classmates list their position as scientist; 14 are lawyers; and two have religious vocations.

Your class secretary's membership on the MIT Corporation's Athletics Visiting Committee brought him and wife **Diane Curtis** back to Boston for a visit in early February. As of this writing, the trip was still one week away. We are looking forward to seeing Boston from a new perspective after having lived there for so many years.

Please send in news of your hobbies, volunteer activities, career, and family news.—**Jim Bidigare**, secretary, 2470 Billingsley Rd., Columbus, OH 43235, (617) 889-1817; **Julie Kozaczka Stahlhut**, assistant secretary for Networks, Internet: jstahlhu@hstbme.mit.edu; Compuserve; Julie K. Stahlhut 76566,1012

79

Lots of new families in this month's column. . . .

Bonnie Mason and husband **Al Chock**, '78, are the proud parents of **Alfred Mason Chock**, born December 7, 1989. Weight: 7 pounds, 11 ounces; length: 21 inches. **Bonnie** writes, "The three of us are doing just fine. We're still trying to adjust to 3:00 A.M. feedings." . . . **Thomas Coate** wrote to announce the birth of his first child, **Emily Catherine**, born May 2, 1989. . . . **Paul Denney** writes, "I got married in April 1989 to **Jeanne Cocolin** and now I'm the father of four children: two boys and two girls; ages 12, 11, 9, and 7. I'm working for **Penn State University** in the area of laser materials processing, and I'm rowing a scull."

Donald Devine is living in **Darien, Conn.** with his wife **Patsy** and their 1-year-old son **Conor**. **Donald** is a vice-president in the **Fixed Income Division** of **Goldman Sachs** in **New York**, and is still playing rugby. . . . **Marvin Chartoff** reports, "I've gone through my second merger in a year. I belonged to a 50-person privately held consulting company (NSI) back in October 1988. Having merged with **Ernst & Whinney**, I'm now with **Ernst & Young**, 70,000-person professional services firm, which resulted from the merger between **Ernst & Whinney** and **Arthur Young**!" . . .

Jamie Bernard has been self-contracting as a structural engineer in aircraft and aerospace. He is happily married with a 2-year-old son. He would love to hear from old friends, and can be reached at 14 Greenfield Dr., St. Peters, MO 63376.

I had dinner recently with my dear friends Arnie and Lori (Ullman) Herman, '81. They brought along a couple of friends, one of whom turned out to be the brother of **Warren Manning**. Here's the latest on Warren: he is a cardiologist at Beth Israel Hospital in Boston. He and his optometrist wife, Sue Rodgin, live in Natick, Mass., and have two daughters: 4-year-old Anya, and 2-year-old Sara. (This should be a lesson to you, boys and girls, that you never know when you will turn up in my column!)—**Sharon Lowenheim**, secretary, 98-30 67th Ave., Apt. 6E, Forest Hills, NY 11374

80 10th Reunion

Hello again! Just a few items in the news this month. . . . **Christopher Huson** wrote last fall that he and his wife, Nan, were expecting their first child in January. Any update, Chris? . . . **Jon Claudemans** and his wife, Jennifer, now have two children, David (5) and Katherine (2). Jon is a senior examiner for Medicare and Medicaid policy at the Office of Management and Budget, White House. Jennifer is a senior analyst at the State Department.

I received a call from **Tim McManus** a few weeks ago. He and Deb Pedersen will be married October 6, 1990, in St. Paul, Minn. Tim is still working as an independent consultant for a defense contractor in Minnesota.

Some news from the medical world: **Daniel Metzger** recently completed 1½ years as a pediatrician at St. Thomas Hospital in the Virgin Islands. (Not bad!) At the time he wrote, he was about to start a fellowship in pediatric endocrinology at the University of Virginia Children's Medical Center. . . . **L. Schoeniger** sent us his address in Baltimore, Md., but no news. . . . **Andrew Braunstein** is practicing surgery in Orlando, Fla. . . . **Diane Patrick** writes that her flourishing internal medicine practice (in Fall River, Mass.) recently acquired a "bouncing 25-lb., 386 20-Mhz computer system" for patient billing. Husband Mike, '79 (the family 6-3), helps out with it.

Jeffrey deRonlet writes from Seattle that he obtained his architect's license in September 1988. In January of this year, he opened an architectural firm, Architects Northwest, in Kirkland, Wash. . . . **Timothy Folster** is working for a general contractor in northern New England as division manager. His firm was recently purchased by a French contractor; the transition has been interesting. (Sounds familiar. My own employer, Squibb, recently "merged" with Bristol-Myers to form Bristol-Myers Squibb Co. Lots of changes have been made—and there's lots more to come, I'm sure.)

After spending over 2 years with Yamaichi International (America), Inc., **Suk Whan Chang** recently took a new position as manager of the International Department, Diashan Securities Co., Ltd. in Korea. He writes: "As the Korean financial industry goes through rapid liberalization and globalization, there lie many exciting opportunities. I will also be actively involved in the venture capital business."

Edward Kwok sends a nice, news-filled letter—1989 was a very eventful year for him. In chronological order: he and his wife became U.S. citizens (March); he graduated from evening law school at Santa Clara University (May); he took and passed the California bar exam (July); his feine "son" turned five (August); he left his job as manager of several computer-aided design projects at Intel (after 5½ years) and joined the law firm of Skjervén, Morrill, MacPherson, Franklin, and Friel as a junior associate (September); and he took and passed the "patent" bar exam (October). He added that, for the first time since leaving MIT, he's working hard again. (But

we won't tell Intel).

That's it for now. I hope to see many of you at our reunion in June!—**Kate Mulroney**, secretary, 118 Riverview Ave., Washington Crossing, PA 18977

81

Happy Spring to everybody! It's hard to believe that nearly nine years have passed since our graduation from MIT in 1981. Please keep in mind that we will celebrate with our ten-year reunion next year.

Donald Jones and his wife, Ruth (Wellesley, '81, Sloan '87) are enjoying life in Cincinnati, Ohio. They are the proud parents/owners of Rigel, a 95-pound great pyrenees dog. Rigel excels at barking and games of keep away. Don is very happy in his position at LeBlond Makino Machine Tool Co., where he supplies technical sales support. . . . Words of advice arrived from **Bill Gardner** who is still working at Kurzweil Music Systems as well as teaching night school at Northeastern University: "I highly recommend teaching. There's no money in it, but it's highly rewarding." Best of luck. . . . **Eric Whitaker** reports that he is still single and is working as an air traffic controller at Bakersfield Airport. He states that he was rather dismayed to see his name in the issue devoted to the safety of the nation's skies.

Harry Atwater is teaching and doing research in applied physics at Caltech for the past year and one-half. His wife Teresa attends Berkeley and is commuting. The Atwaters purchased a house in Pasadena last July. Congratulations to Harry on the receipt of the prestigious National Science Foundation President Young Investigator Award and the IBM Faculty Development Award. . . . Another recipient of the prestigious National Science Foundation President Young Investigator Award is **Laurie Butler**, who is currently an assistant professor in chemistry at the University of Chicago. Laurie also received one of 14 Dreyfus Foundation Teach-Scholar awards for 1989. Laurie received her PhD from Berkeley in 1985. Congratulations.

Bruce Novich is vice-president of research, development, and engineering at Ceramic Process Systems Corp. in Milford, Mass. Bruce has received five degrees from MIT including an ScD. . . . **Eric W. Brown** writes: "In July 1985, I started a company in my living room with the support of two physicians. Today I-FLOW Corp. has developed a unique line of equipment for treating cancer, AIDS, and other types of patients requiring complex intravenous therapies. Our multi-drug infusion system can help patients get treated in the comfort of their homes." Their equipment received FDA approval in 1989, and the company traded on the NASDAQ. Congratulations to Eric, president and CEO of I-FLOW Corp.

Please keep writing.—**Lynn Radlauer Lubell**, secretary, 2380 NW 41st St., Boca Raton, FL 33431

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Please send news to your class secretary.—East Coast correspondent **Linda Schaffir** (50 Aiken St., #512, Norwalk, CT 06851), West Coast correspondent **Michelle Gabriel** (656 S. Fair Oaks Ave., D-211, Sunnyvale, CA 44086), **Stephanie Pollack**, secretary, 135 Sutherland Rd., Brighton, MA 02146

83

We set a class record this month for number of letters received for this column—two. It seems all of my appeals are finally hitting home! **Wendy Rowe** writes that she and Pace Willisson were married in May 1987 and currently own a house in Somerville, Mass. Mary and Pace met at LISP

Machine, Inc., which employed them both for about three years. Mary then worked at BBN Advanced Computers, where she recently left to have a son, Eric Palmer, born November 19, 1989. Pace has started a consulting firm, Blitz Product Development Corp. He is also doing work on the GNU project (whatever that is). Congratulations to both Mary and Pace—marriage, child, house, and starting a company—that's what I call hitting for the cycle!

I have found that if you want people to write in for the column, just print things that aren't true about them. This worked for **Steve Lubiak**, who has since written to amend **Steve Kosowsky's** (finally spelled correctly) portrayal of his activities. Steve Lubiak married Diane Davignon (Wellesley '82), and they have a daughter, Stephanie, age 2. He currently works at a product manager for the Howmedica Division of Pfizer, Inc. The division sells orthopedic implants and prostheses, and Steve is handling hip fracture appliances. Steve also reports that he is serving as an MIT educational counselor, interviewing prospective applicants. This may surprise Steve's close friends who know that Steve really couldn't stand the place while he was there!

The following people took the time to jot down what they were up to while giving to MIT: **Hal Lonas** is a project leader at Optographics Corp. in San Diego. Hal and his wife Raquel have two daughters, Stephanie (3) and Emily (1). . . . **Rick Norton** received his PhD in polymer science and engineering at UMass/Amherst in January 1989. He is now working for Eastman Kodak in copy products R&D in Rochester, N.Y. . . . **Ramin Khorram** reports that he worked on a laser art exhibit that was displayed in the Infinite Corridor during graduation week. He is now living in Derry, N.H. . . . **David Cooke** and Sara Keagle Cooke, '85, are expecting their first baby in March. David will be finishing his pediatric residency this year, and staying on at Hopkins for an endocrinology fellowship. . . . **Steve Isakowitz** and his wife, Monica, recently became parents for the second time. The newest addition is daughter Jennifer Erin, born October 3, 1989. Jennifer's brother, Matthew Scott, turned 2 last August. Steve is working for Martin Marietta in Denver.

Jeff Muss reports that he will be restarting his PhD in rocket science this fall. You can find Jeff in Sacramento, working for Aero-Jet. Jeff also reports that **Brian Jacobs** has announced his engagement to a Stanford Business School classmate named Allison. This news comes to us just before the copy deadline, so more details will follow when available. Brian's WMBR morning show partner, Spike Graves, '82, will also be getting married to longtime girlfriend Karen this June.

I just returned from a three-week trip to New Zealand and Australia with Rich "Ski" Kosowsky, '82. The highlight of our trip occurred in Queens-town, New Zealand, where we bungie jumped off a 143-foot bridge into the river below. Our activities also included scuba diving on the Great Barrier Reef and parachuting off the side of a mountain. True to form, Ski was found climbing up the roof of the Sidney Opera House (it reminded him of a similar experience on Kresge).

Lastly, as those of us in Boston settle into cold dark February, I'd like to remind you that one of the most charitable things you can do is send your secretary a postcard from a warm exotic place. Remember, you'll get bonus points for good humor. Keep those cards and letters coming!—**Jono Goldstein**, secretary, 2 Soldiers Field Park, #201, Boston, MA 02163

84

We begin with several items held over from last issue that were gleaned from the New Year's party at the **Cravens**. . . . **John Carl Adams** is still shamelessly squandering taxpayers' money at NASA. . . . **Tim Sullivan**, '85, was married a while back to Cindy, a nutritionist. Tim is an avionics systems analyst. They are both involved

with the church in Grand Rapids, Mich., leading biweekly Bible studies and more. No kids yet, house soon.

Dennis Sacha and Denise, '87 (the newlyweds), will be heading to Spain for a 3-year assignment. They welcome all guests: "nosotros providamos las comidas y les cervezas." In preparation they donated their dog to Seeing Eye, Inc. . . . **Anne (SK) Lavin**, '85, is still working for project Athena. She moved out of way-too-expensive Beacon Hill to a really cool apartment near Davis Square. Turbo and Cleo still rule the roost.

Michelle Keller has a baby daughter, Anna Lynn, who, by now, is 1 year old. Ray and she are still living and working in Maine. . . . **Peter Lemessurier** has been working as a HVAC/Energy facilities engineer and consultant. He says he is considering becoming a self-employed home inspector (where the AC is LV, if I've got it right).

. . . **Ed Seidewitz** is working at NASA Goddard Space Flight Center and has recently become a project manager for a seven-year software development effort. Earlier last year, Ed received the Goddard Exceptional Achievement Award. Last summer he visited France with his wife, and they were in Paris for the Bastille Day Bicentennial (probably crazier than Times Square on New Year's eve).

Stephen McDonald is working at MIT in the EAPS Department. He is looking for candidate stars for occultation by Pluto in the next 10 years. Stephen was married last June and is still active in APO (do the two have anything to do with each other?). . . . **Gregory Skinner** is a grad student in UCLA's MSCS program, specializing in the modeling and analysis of computer networks. Greg is in touch with **Ted Kim** and **Joe Pemberton** also in UCLA's CS grad program. Greg sounds happy with his decision to try the left coast.

Stuart Gitlow, MD, is in his second year residence at the University of Pittsburgh. He is also working on a master's in public health and runs Symposia Inc., a Macintosh multimedia software firm. (Obviously, Stuart does not sleep.) He recently spent four months near Denver hiking the Colorado wilderness and re-restoring his '66 Mustang that had endured Westgate and the New York City streets. The odd part of Stuart's letter was the one of the stamps on the envelope was a 3-cent stamp issued in 1938. Care to explain?

What season is it? Am I a Dr. yet? From Boston, **Howard Reubenstein**, secretary, 38 Belknap St., Somerville, MA 02144, (617) 625-9299, hbr@ai.mit.edu.

85 5th Reunion

Roy Peterkofsky ran the Marine Corps marathon (his first and last!) in Washington last November. His new job at USAir is going great and he will be traveling all over the place soon. . . . **Leif Ulstrup** is working for American Management Systems, Inc., as the product manager for a software quality CASE tool known as Logiscope. . . .

Townsend Thomas got married in December 1988 and is working in New York City for a financial software services firm, FactSet Data Systems.

Stephen Olson married Susan Lee Koallick last November 4 in Peterborough, N.H. Susan works as a cartographer at the Mitre Corp. in Burlington, Mass. Stephen works as a staff engineer at Lincoln Lab in Lexington, Mass. After their honeymoon in Canada, they settled in Arlington. . . .

Michael Reese recently married Leola Alfonso, '84, Course VI-3. . . . **Joan Muellerleile** is engaged to Dumont M. Jones. The wedding is set for January 1991. Joan is working toward a PhD in materials engineering science at Virginia Tech. Her anticipated degree completion date is late 1990 or early 1991. Dumont works at TRIPOS Associates, Inc., St. Louis, Mo.

Steve Golson was visiting a friend in the San Francisco Bay area last October 17 when the earthquake hit. He wrote an article about his experiences in the *Carlisle* (Mass.) *Mosquito* weekly.

He tells about his seismology professor who compared the danger of an earthquake to using the Mass. Ave. crosswalk against the light. Steve was in the main ballroom of the Milpitas Holiday Inn when the shaking began. When the natives all dove for cover under the tables, he sought out a spot under an overhang. Fortunately no one was hurt, even though a couple of the chandeliers fell and shattered on the tables.

I have some sad news about **Ben Tien**. On April 2, 1988, Ben was hit by a car while riding his bike. He suffered a traumatic brain injury and was in a coma for eight days. At that time, he was in his third year of his PhD program in electrical engineering at UC/Berkeley. Ben received a scholarship to participate in a head injury rehabilitation program in Washington. He has difficulties in basic skills that most people take for granted, such as sequencing, memory, and the ability to problem-solve. The program includes physical, occupations, and cognitive therapy. He is currently taking graduate level courses in electrical engineering at the University of Washington to help him relearn the skills necessary to return to school full-time.

The Class of 1985 would like to invite fellow alumni/ae from the classes of 1981 to 1989 to join us at our Gala Night at the Children's Museum on Saturday, June 9. This special evening will include food, drink, dancing and casino. If you are interested, please contact the MIT Alumni/ae Association, 10-140, 77 Mass. Ave., Cambridge, MA 02139, (617) 253-8230. Our class is sponsoring this event along with the classes of 1975 and 1980.—**Stephanie Winner**, secretary, 1026 Live Oak Dr., Santa Clara, CA 95051, internet:winner@apple.com

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Cabin fever must have set in because I received a few letters this month. Thanks! **Sharon Israel** wrote in with a veritable wealth of knowledge about other classmates. Sharon is currently at Emory University in Atlanta, Ga., pursuing both her law degree and MBA. She'll graduate in May 1991. This summer she'll be working for Townsend & Townsend in San Francisco, an intellectual property law firm (Patents, copyrights, etc.). . . . **Steve Yon** is the only other alumni Sharon could find in the Atlanta area. Steve has been there about a year and is working with NCR. Since Sharon spent the last two summers in Washington, D.C., she ran into quite a few alumni. . . .

Beth Dernbach moved to Pittsburgh, Pa. (actually Monroeville, Pa.) where she is working for Westinghouse. . . . **John Villani** is in his second year of law school at Syracuse University. . . . **Marta Diaz** is working for an economic consulting firm in Harvard Square. Her firm benefits aren't too bad—she's being sent to Mexico City; Caracas, Venezuela; Buenos Aires, Argentina; and Bogota, Colombia for three weeks this month (February). . . . **John Swartz** is getting married in September to Carol Strong, an RPI grad. . . . Sharon spent a few days last summer with **Yong Mi Choi**. Yong Mi should be finishing up her PhD in chemistry at UCLA in September. . . . **Cheryl Ingram** is still working on her PhD in molecular biology at UPenn. . . . **Rose Joseph** is working on her PhD in electrical engineering at Northwestern, and **Hannah Bond** is working for GE in Princeton, NJ. Soon, Hannah will be working on an MBA as well.

Robert Sabo just got a residency in neurosurgery in Peoria, Ill. He is presently engaged and will be married in June after his graduation from Jefferson Med School in Philadelphia. . . . Sharon also ran into **Vivienne Lee**, who is still working for Proctor and Gamble in Cincinnati, Ohio. They're trying to get some ideas for our five year reunion next year, so if anyone's got any, send them to me and I'll pass them along. . . . **Brian Latt** just finished working on the special effects for a TV movie (USA Cable TV) starring Rae Dawn Chong and C. Thomas Howell entitled

"Curiosity Kills." . . . **Mark Shelley** is living in downtown Denver, Colo., working for Martin Marietta Space Systems. . . . **John Wang** returned to MIT last fall to begin work on his PhD in electrical engineering. . . . **Aya Konishi** is in the first year at the Fletcher School of Law and Diplomacy (Tufts University), trying to be an international civil servant.

Adrienne Ono is still struggling through grad school at UCLA Department of Earth and Space Science. She's working on the infrared radiometer on the Mars Observer Spacecraft set for launch in 1992. Her husband, **Scott Texter** works for TRW on AXAF, the X-ray telescope project, one of NASA's great telescopes that will orbit the earth (launch in 1997). . . . **Walter Santarelli** is completing his first semester of grad school in computer science at the Moore School of Engineering and Applied Science at UPenn. He's hoping to get a PhD, but an MS may suffice. . . . **Lt. Karin Getschow** is expecting her second child in March (with her husband Christian Getschow, '85).

I ran into Dave McKay, '84, at Edwards AFB, Calif. The Air Force Systems Command Women's Volleyball tournament was held there in February. Los Angeles AFB walked away with first place. Immediately following, I spent President's Day Weekend skiing at Taos, N.M. It's almost time for beach volleyball! Yeah! Thanks for all the letters. Keep up the good work.—**Mary C. Engebretsh**, secretary, 1800 Hermosa Ave., #A, Hermosa Beach, CA 90254

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Congratulations to **Carol (Webb) Mohr** and Bill Mohr, '84, on the birth of their daughter, Margaret Lloyd! Carol has just had a story published in *Fishes*, a literary magazine based in Houston, where she and Bill have been living since October. They plan to visit Palo Alto on April Fools Day for the wedding of Brian White, '85, and Julie Schwedoch, '85. . . . Congratulations to **Dave Luneau** and Henrietta on their recent engagement and to **Mike Vogel** and Ann on their engagement. . . . Congratulations to **George Capek** and Lori Pimental! Their wedding took place last September 23.

Dana Takaki is working at KLA in Santa Clara in product development. . . . **Christopher Wolfe** joined the GE Research and Development Center as an aeronautical engineer on the Research Technology Program. Chris earned an SM in aeronautical engineering in 1989 from MIT. Chris now lives in Schenectady. . . . **Steven Holzinger** joined Boston Systems Group as an associate. Steven will work primarily in BSG's systems development practice, where he will be responsible for a variety of projects that BSG has under way for several large insurance companies. Before coming to BSG, Steven was systems manager for the MIT Property Office. In this position he was responsible for developing, maintaining, and administering a variety of distributed application systems that operated on a broad range of microcomputers and were served by a combination IBM/DEC local area network.

Navy Lt. (jg.) **Michael J. Dennis** was recently designated a naval flight officer upon completion of the overwater jet navigation phase of training and received his Wings of Gold while serving with Training Squadron 86, Naval Air Station, Pensacola, Fla. During the 15-week phase of training, Dennis received intensive classroom, simulator, and airborne instruction in the Citation II and Skyhawk aircraft. Flight training included work in low-level high-speed visual navigation, high-altitude instrument navigation, low-altitude ground-and-surface search radar navigation, and air tactical maneuvering. Dennis will continue his training in the aircraft carrier based S-3 Viking.

And now some information passed along through the wonders of electronic mail: **Krishna Komanduri**'s time in medical school in Minnesota is coming to an end, and his search for a residency will begin soon. Krishna writes: "Say a

warm hello to all your fellow Bakerites in exile—yes, even Lowell.” . . . **Greer Tan** says: “A friend of mine (Scott Lawton, ’86) started a company, Celadon Corp., in Waltham and asked me to join his team. As employee number 2 (he’s the first), I’ve been here for six months as of February. Celadon’s current product is ‘fresco,’ an image management software package running on UNIX for workstations. I’m a (the) software engineer here. We’ve only got five people in the company—the president, the software engineer, the vice-president of marketing, the director of sales, and the executive secretary. We have a slew of consultants and contractors, of course. I sold my townhouse in Pasadena and am now getting totally spoiled at home in Canton, Mass. I’ve been in cahoots with Rob Swiston, ’88, electronically. He seems to be doing fine at Oracle as the official Apollo group. I’ve talked to **Toai Doan**, out in Shrewsbury, Mass., working for DEC. Being an active member of corporate SWE and AMITA, I’ll be participating in the annual high school rounds. We are spending some time with high school students, talking to them specifically about engineering and science, but more importantly trying to bring their attention to the growing population of *women* in science and engineering. Trying to create a new role model. Anyone who is interested should contact **Marti Ward** at (617) 253-3355.”

I want to thank **Lowell Kim** for being such a good friend and for delivering this article to the Review Office for me. Don’t forget to write (or send e-mail)—**Stephanie Levin**, secretary, Lip-Nose House, 41 Prentiss St., Cambridge, MA 02140 (or dkennedy@oracle.com or atthema.mit.edu@MERLIN.MIT.EDU)

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Summer again! Once again I will be working at Mass. General Hospital doing research in the Department of Orthopaedics. What about all of you? We would love to hear of your summer activities.

Nicole Stucki is enjoying law school at NYU and is focusing on environmental law. . . . **Allen Fullerton** (was) doing graduate work in electrical engineering control systems at Brown University. . . . **Adam Sawicki** is working on a master’s degree at MIT, hoping to graduate in June 1990. . . . **Ernest Prabhaker** is pursuing a PhD in physics. He met **Tom Junk** at Stanford in Bible Study with **Elizabeth Duxbury**. . . . **Alexandra Page** and **Julie Levine** are at Harvard Med and University of Miami School of Medicine, respectively. Julie is doing research at Bascom-Palmer Eye Institute.

Bertil Chappuis is working in technology policy development for the Corporation for the Technological Development of Tropical Resources in Puerto Rico. He is promoting biotechnology commercial and research and development projects in Puerto Rico. . . . **Reed Steinmetz** married Jennifer Fleet (Wellesley ’87) in August 1988. He has been working for Merck and Co., Inc., since graduation. . . . **Paul Paternoster** is working hard in the lab for DEC’s VAX-9000, but is still playing his saxophone in a couple of bands. He’s engaged to Boston Conservatory graduate Kimberly Williams. Their cat, Egon, sends his regards. Congratulations to all.

Don Woodlock, **Rob Shaw**, **Glenn Cooper**, **Pat and Trace Garbridge**, **Dave Horrigan**, **Mike Munoz**, **Alec Jessiman**, **Armando Fox**, ’90, and **Jack Kotovsky**, ’90, all met in Utah for a “fun-filled week of skiing, hot tubbin’, drinkin’, and paintin’ Salt Lake City red.” (My poor hometown!) Don is climbing the corporate ladder in Boston; Rob is still programming for the University of California; Glenn is working for the Navy in the nation’s capital; Pat is “writing plays and screenplays and still looking for his big break”; Tracy just finished a master’s at Columbia and is not looking forward to working full time at Bell Labs; Dave is living all over the country (NYC, Tampa, LA, etc.), making “loads of money, and doing squat”;

Mike survived the quake and is still working for IBM in San Jose; and Alex is working and taking classes at Harvard.

Catherine Cherubino relocated from NYC to the Bay Area in California. Although she missed the City somewhat, her tennis game is improving, as she can spend lunch hours on the court year-round. She is working for Oracle Corp. along with a few other classmates. She is working in the same group as **Paul Laporte** (Lamba Chi). . . . **Darryl Toney** (East Campus) works in the Data Center. . . . **Rakesh Shukla** (Sigma Chi), works in marketing, and **John Ramsey** (Lamba Chi) works in the porting group. . . . **Sameer Ghandi** is working in the Oracle training courses, and Catherine has ended up teaching a few other MITers: Rosanne Park, Steve Platakis, Ivan Chang, Tim Maddox, all ’89. . . . **Kelly O’Neill** was out visiting in last November/early December. She lives with **Julie Zimmerman** in Brookline. Catherine bumped into **Jeff Cohen** (TDC) and **Eric Troelson** (Phi Delt) in a club in San Jose in November. Both are doing well.

Gillian Brown and **Don McMahon** are pursuing graduate degrees from Berkeley. . . . **Kristy Dowers** (Next House) is in West Germany. She and her boyfriend plan to stay in Boblingen for one-and-a-half to two years. Kristy completed several courses at the University near Stuttgart and is currently interviewing with Hewlett-Packard.

Steven “Benny” Stein updates us on the whereabouts of some of our fellow classmates. Steve “just made a discovery that *Quincy, M.E.* made pathology look fun—but it’s not.” Over Christmas, he went to Lake Tahoe with **Tom Murray**, **Chris Racicote**, **Denis Gulsen**, **Terry Olkin**, and **Cathy Sybert**. Tom lives in L.A., one block from the beach. Chris used to be his roommate but just moved up north to work for Oracle with Terry. Terry used to room with Denis, but “they decided they hate each other’s guts, so Chris moved in with Denis in Sunnyvale and Terry moved somewhere else. (Sounds like one of the LSAT mind games, huh? You figure it out.)” Denis has recently left his job at AMD (although he still consults for them), and is working for the TAV Corp. Cathy received a master’s in Aero-Astro and now works for JPL. So much for the West Coast, and now for the East.

Steve Stein went to Sugarbush with **Andy Brochman**, **Tareq Hoque**, **Joe Rondinella**, **Larry Claman**, **Perry Ziff**, **Laura Flemming**, ’90, **Toby Sanders**, ’90, and **Les Kalman**, ’92. Andy works for Bellcore and has two messages: “Phone cops play hardball, and thank you for using AT&T.” Joe is working in Brooklyn in his father’s shoe store. Larry and Perry are roommates in the “If you lived here you’d be home now” building (How many of you would know the place as Charles River Park?). They are officemates at McKinsie and Co. in Cambridge. . . . **Michael “Chez” Cohen** has a civil engineering job in the Boston area, and wedding bells are in his future. He just announced his plans to marry in August. Also headed towards the altar is **Brad Fenton**. Brad is an MD/PhD student at BU, and he met his fiancée in the Anatomy Lab (care to elaborate?). Congratulations, at any rate!

Now for the “Middle of the Country.” **Scott Lordi** is doing physics at the University of Illinois, Urbana/Champagne and rooms with **Tony “M.P.” Curtis** who is studying either physics or electrical engineering there. Scott says the Midwest is as boring as (your descriptive word here). . . . **Mark “eul” Longtin** is leaving his job in Chicago to go to business school in Boston. (He’s in BU, but awaits news from Harvard and MIT). . . . **Howard “Banana” Tam** works for 3M in Minnesota, trying “desperately to improve scotch tape” (disclaimer: I just report what I’ve been told). . . . **Allan Sbara** will get his MBA from the U. of Michigan in May. . . . Thanks to all who’ve written, and I hope to hear from more of you!—*Note temporary summer address: Grace Ma, secretary, 1199 Bonneville Dr., Salt Lake City, UT 84108*

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Hello! I’ve noticed that people have responded to erroneous information about themselves; however that doesn’t mean I’ll try to generate errors! (People will write anyway, won’t they?)

Here are some corrections to previous articles. . . . **Gary Curwin** is not in Phoenix but is working for Pheonox Industries in Long Island. . . . **Vincent Chau** is at the University of Chicago, not at Northwestern as previously reported. Also at the Pritzker School of Medicine with Vince is **Mike Lam**. Vince spent the summer touring Europe with **Andrew Tompkins** and **Curtis Eubanks**. Vince has run into **Dickson Cheung** at Northwestern.

Kai-Yee Ho is finishing up his 6-A with Raytheon. . . . **Chris Rehmann** is working on a civil engineering PhD at Stanford, where **Rachel Duncan** is working on a chemistry PhD. . . . **Stacey Rogers** is traveling to the Far East with the Navy. . . . **Matt Machlis** is aero-astro at MIT, and **Michael Malak** is at Caltech. . . . **Deborah Kuchnir** has won the Apker Award from the American Physical Society, the most prestigious award offered at the national level to undergraduates in physics. Deborah was the society’s guest at its January meeting in Atlanta.

Christine Leviness is working for Arthur Andersen in New York but until April had been based in Harrisburg working for the Pennsylvania Department of Transportation. She says that it has been difficult to stay involved in the New York MIT Club activities, but she’s been looking into the MIT club near Harrisburg. She writes that while in New York, she ran into **Jeff Traub** at a club.

Christine also writes that **Lisa Robinson** is working in Maine. . . . **Amy Meyers** is working in Texas for a chemical engineering company. . . . **Debbie Schnek** is studying for a master’s in chemical engineering at Caltech. . . . **Muriel Medard** is at MIT. . . . **Suzanne Driscoll** is doing biology research at Columbia.

Karen Yu writes from Nashville, where she is continuing her work in human visual perception at Vanderbilt. She enjoys the lab she is working in, but reports that Nashville takes some getting used to after four years of Boston. Karen has made her research proposal to her faculty committee, and is excited to start a new set of experiments.

I was visiting Boston at the end of January and ran into a lot of classmates. Class vice-president **Dave Duis** is living in Ashdown this term and is looking for a job. I also ran into Class President **Carissa Climaco** and **Kenny Ng**. **Sam Hou** also finished his VI-A and is “TAing” 6.111 this term, as is **Malini Ramaswamy**. Sam will be probably be going out to Stanford in the fall, and Malini is staying at MIT.

Housemates **Tim Sulzbach**, **Andy Shaw**, **Sam Drucker**, **Sayan Chakraborty**, and **Mike Berube** had a housewarming party at their place in Somerville. Sam is returning to MIT; Mike is with the Technology Policy Program; and Tim is TAing 6.012 this term. Spotted were **Derek Chiou**, **Ron Koo**, **Bill Jarrold**, **Brian Luschwitz**, **Carol Wu**, **Cindy Wang**, and **Alice Biber**. Alice, who was busily trying to finish her thesis before the end of IAP, is TAing 6.101 this term, and Bill is working in the Media lab. Cindy and Carol are now roommates at Green Hall. Carol finished her VI-A with Motorola in Chicago, where she was rooming with **Kyle Kapuscinsky**, ’90, for the summer. Also present were **Alissa Fitzgerald**, ’90, **Walter Chung**, ’90, **Beth Kulas**, ’90, **Julie Ask**, ’90, **Desmond Davis**, ’90, **Nina Chen**, ’90, and **Toby Snaders**, ’90.

To make it easier to get class news, I will include my e-mail address in this and future columns. Thanks to all who wrote, and thanks to the hoards who are thinking of picking up pen and paper right now!—**Henry Houh**, secretary, 5380 Hollow Dr., Bloomfield Hills, MI 48013, e-mail:tripleh@athena.mit.edu



COURSE NEWS

I CIVIL ENGINEERING

Ross E. McKinney, ScD '51, writes: "In May 1989 I visited the PRC for a three-week lecture tour. While there I visited Tiananmen Square and saw the students marching to the square the Sunday before the problems occurred. I went to Chengdu and Leshan where I visited a solid-waste recycling plant under construction. After two days of lectures in Chengdu I returned to Beijing on the morning of June 4 and was unable to enter the city. I spent the day at the airport and heard first-hand what had happened earlier that day. My flight was cancelled and I spent the night as a guest of the army at an officers' R&R camp near the airport. I caught the last plane out of Beijing on June 5 and flew to Huhehot, Inner Mongolia, for lectures and visits to waste treatment plants. On my return to Beijing I went into town and saw the troops occupying the city. It was great to return to the USA."

Richard de Neufville, '60, chair of MIT's Technology and Policy Program, has been selected as one of the US-Japan Leadership Fellows. He will spend the 1990 fall semester in Japan meeting with industrial, political, and research leaders in technology policy. The Leadership Program, sponsored by American and Japanese corporations, provides national leaders in various professions with more knowledge about Japan and the U.S.-Japan relationship. . . . MIT Professor of Civil Engineering **Daniel Roos**, '61, has been named winner of the ASCE Frank M. Masters Transportation Engineering Award. Roos is the Japan Steel Industry Professor of Engineering and director of the Center for Technology, Policy, and Industrial Development. The award is given on the basis of the best example of innovative or noteworthy planning, design, or construction of transportation facilities. Roos has led a number of major research studies including ICES (Integrated Civil Engineering System), a large-scale computer system that has been implemented by several thousand organizations; Dial-A-Ride, a demand-responsive public transportation system; and the development of a transportation energy contingency plan for the United States.

In 1988, Professor **M. David Egan**, SM '66, began serving a two-year term on the architectural advisory board of the Savannah College of Art and Design (SCAD) in Savannah, Georgia. He also serves on the editorial advisory board of *Architectural Lighting*, a magazine published in New York City by Gralla Publications. . . . **Roberto Lenton**, PhD '74, is director-general of the International Irrigation Management Institute, headquartered in Colombo, Sri Lanka. The Institute, which seeks to improve the performance of irrigation systems in developing countries through the development and dissemination of management innovations, now has field offices and research programs in nine countries of Asia and Africa. . . . **Dennis A. Roth**, SM '72, is president of Structural Engineering Corp. with offices in Pittsburgh, Penn., and Alexandria, Va. The company serves as consultants to architects on commercial, institutional, and residential buildings.

Lewis Edgers, PhD '73, a member of Tuft's civil engineering department since 1972, has been promoted to professor of civil engineering. His research interests include geotechnical engineering. . . . **Richard S. Ladd**, SM '66, reports that he was elected chair of the ASTM committee D18 on soil and rock. . . . **Captain Albert M. Bleakley**, CE '85, writes that he returned from a four-year assignment as an army engineer company commander. He is now assigned to the Corps of Engineers Fort Worth district as a project officer at Kelly AFB, in San Antonio, Tex. Bleakley spent a month in the San Francisco area doing disaster relief work with the Corps. He was the area commander for the Oakland/Alameda County Individual Assistance Program in charge of 90 Corps inspectors.

The American Geophysical Union recently awarded to **Alonso E. Rhenals**, CE '75, the Editor's Citation for Excellence in Refereeing for "outstanding service to the authors and readers of *Water Resources Research*."

Leon Ru-Liang Wang, ScD '65, has been elected president of the Eastern Virginia Chapter of the Organization of Chinese-Americans (OCA/EVC), a non-profit, bipartisan organization of concerned Chinese-Americans to promote active participation of Chinese-Americans in civic and national affairs and to foster Chinese cultural heritage. In addition, Wang visited Taiwan, Hong Kong, and Macao for three weeks in June of 1989, but cancelled his trip to mainland China due to the Tiananmen Square incident. . . . **Richard Kossik**, SM '86, is working as a contaminant hydrogeologist for Golder Associates, Inc., in Seattle, Wash. He spent four months working on hazardous waste projects for Golder's Melbourne, Australia, office. . . . **Robert F. Lathlaen**, SM '46, reports that he is chair of the National Construction Industry Arbitration Committee, member of the executive committee of the American Arbitration Association, and chair of the contract documents committee of the Association of General Contractors of America. . . . Major General **Robert F. Seedlock**, SM '40, won the Case Institute of Technology Alumni Association "Gold Medal" Award. . . . **Frederick H. Pickel**, PhD '82, writes: "I've moved from Pacific Enterprises' corporate strategy and development group down into Southern California Gas' group that buys gas for their four million customers. I've also joined the board of trustees of Harvey Mudd College for a three-year term."

II MECHANICAL ENGINEERING

Professor **Nam P. Suh**, '59, a mechanical engineer respected internationally for his contributions to the science of manufacturing, has been named the first holder of the **Ralph E. Cross**, '33, and **Eloise F. Cross** Professorship in Manufacturing at MIT. Suh has made seminal contributions to his field, developing a series of patented processes for the manufacture of metals and polymers, and formulating the delamination theory of wear. He has developed a set of axioms for designing

manufacturing processes, has written more than 200 papers and 4 books and has been awarded 30 patents for inventions in manufacturing and materials processing. Cross is a pioneer in the machine tool industry. He is the former chair of the board of Cross and Trecker, one of the largest machine tool companies in the world. Among many other accomplishments, he engineered the design and manufacture of the first transfer lines for the automotive industry, eventually transforming the Cross Co. into the leading machine tool manufacturer in the field of computer-integrated manufacturing systems.

Peter H. Meckel, PhD '88, writes: "I am currently assistant professor in the School of Mechanical Engineering at Purdue University in West Lafayette, Ind. Our first child, Paul, was born May 20, 1988." . . . **Serope Kalpakjian**, SM '53, reports that he received the 1989 "Education Award" from the Society of Manufacturing Engineers. His new textbook, *Manufacturing Engineering and Technology*, was published by Addison-Wesley in March 1989.

Richard A. Bird, SM '66, is the new publisher and president of *New England Business* magazine, Boston, Mass. . . . "Since leaving Xerox in 1986," writes **Bill Verplank**, PhD '77, "I have been teaching human factors to designers at Stanford (part-time) and consulting on user-interface design through the international product design firm ID TWO (full-time). My wife Dolly and seven-year-old son Jansen will go with me to the Netherlands this spring for three months in Eindhoven (Philips). Last year we all spent two months in Cambridge, England." . . . **Jeffrey K. Raines**, PhD '72, is an associate professor at the University of Miami School of Medicine and director of the Center for Vascular Technology. He travels widely and still enjoys his MIT and Boston contacts.

Frank Tai, SM '80, writes that after spending a decade in aerospace engineering, he started his own engineering consulting company, Technology Advancements, Inc., in May 1989. His principle customers are the large Southern California aerospace firms as well as smaller companies that are interested in innovative approaches.

Lawrence L. Hofstein, SM '38, is "still enjoying my retirement. I won a first place for sculpture and a third place in mixed media at a juried local art show. It's nice to be just beginning at 74!" he writes. . . . **Boris Rubinsky**, PhD '81, reports: "I am a professor of mechanical engineering at the University of California at Berkeley. Last December I received the 'Larson Memorial Award' from ASME for outstanding performance in mechanical engineering. The award is given to graduates from an engineering curriculum who are between 10 and 20 years after graduation. My research is in the area of material processing and bioengineering. The work in bioengineering has been recognized in the last six years by seven different awards. Among my major accomplishments are the development of a new method for treatment of cancer in the liver using cryosurgery monitored by ultrasound, and new experimental and analytical tools to study heat and mass transfer phenomena of importance in life processes and

in bioprocessing." . . . **David N. Plummer**, ScD '74, sends word that he has been with R&D Associates for almost 12 years, working as a SETA contractor to the Air Force Weapons Lab. Plummer works primarily on research of advanced chemical laser systems.

B. Gordon Watkins, Jr., SM '53, writes: "I am a founding partner of The Greenwood Partnership, Engineers-Architects. The firm began operations in May 1988 and now employs 50 professionals. It serves industrial and commercial clients throughout the eastern half of the United States and features advanced networked computer and CAD systems. My son, Gordon III, began his doctoral studies in economics at MIT in September, 1989."

. . . **Thomas A. Blatt**, SM '59, founded Intrax Corp. in 1975 to provide international business development and consulting services. In October 1989, they established a branch office in Budapest, Hungary, to assist American companies wishing to do business there. The company also provides export/import services to and from Hungary.

Milton B. Hollander, SM '53, has been named CEO of Newport Electronics, Inc., in addition to his ongoing capacities as chair and owner of the firm and executive vice-president of Technology Marketing, Inc.

George F. Williams, Jr., SM '67, has been named chair and CEO of Sam Gronich Associates in Milton, Mass. Formerly he was vice-president for engineering at Sanborn, Inc., in Wrentham, Mass.

Donald P. Traviss, PhD '72, of Barrington, Ill., has been appointed vice-president of UOP's Engineering Products and Business Development Group. Formerly, he was vice-president of Union Carbide's Catalyst, Adsorbents, and Process Systems Division. UOP, a joint venture of Union Carbide and Allied Signal, is a process licensing, process equipment, catalyst, and service company that serves the worldwide refining and petrochemical industries. . . . The United States Metric Association has elected **Stanislav R. Jakuba**, SM '70, as vice-president. He is the president of S.R. Jakuba Associates, a consulting firm in West Hartford, Conn., and is an author, lecturer, and holder of several patents.

Commander **Arnold F. Pyatt**, SM '65, USN (Ret), died on May 13, 1989. Pyatt's 20-year career included duty at sea and in ship salvage, ship repair, and new construction in the US and overseas. He received the Meritorious Service Medal and the Navy Commendation Medal. After retiring from the service, he began a second career with General Electric, advancing to the position of manager of their marine program. . . . The Alumni/ae Association has been notified of the death of **Carl Rolle**, SM '33. At the time of his death he was residing in Laguna Beach, Calif. No further information was provided.

III MATERIALS SCIENCE AND ENGINEERING

Edwin L. Thomas, a widely noted teacher and researcher in the fields of polymer physics and engineering, has been appointed to the MIT faculty as the Morris Cohen Professor in the Department of Materials Science and Engineering at MIT. Thomas will also direct the Program in Polymer Science and Technology. **Morris Cohen**, '33, Institute Professor Emeritus and professor emeritus of materials science and engineering, is one of the world's foremost metallurgical scientists. He has made major contributions to the understanding of the structure of matter and the ways in which various materials, particularly iron and steel, can be processed to provide improved structures and devices. Thomas, who was most recently associated with the University of Massachusetts, has research interests that center on the application of electron microscopy and small angle x-ray problems, particularly morphology-mechanical property relationships in high-performance polymers. In 1979, Thomas was a

member of the first Polymer Physics Delegation to the People's Republic of China. He has published extensively and has received several awards.

Michael F. Rubner, PhD '86, is the first recipient of the Class of 1957 Career Development Professorship. The appointment is for a three-year term. The chair recognizes innovative and imaginative teaching by gifted young faculty members who show exceptional promise of making important contributions to teaching and research. Rubner's broad area of research is the synthesis characterization and properties of polymers with novel electrical, optical, and mechanical properties.

Douglas W. Fuerstenau, ScD '53, was awarded an honorary doctorate from the University of Liege in Belgium for "his extensive contributions on the application of interfacial phenomena to flotation and extractive metallurgy." He was also named an honorary member of the AIME. . . . From Tokyo, **Tom Clevenger**, ScD '61, writes:

"Japan is a busy place these days. Consulting here continues to be more than a little interesting. My son, Douglas, graduated from Tech in 1988 so I'm not getting back to campus as often as in the past." . . . **Peter Tarassoff**, ScD '62, of Beaconsfield, Quebec, was appointed vice-president and chief scientist at Noranda Inc., in July 1988. He is the president-elect of the Canadian Institute of Mining and Metallurgy.

Ernst B. Weglein, MTE '59, is general counsel at Malden Mills Industries, Inc., a manufacturer of apparel and upholstery fabrics located in Lawrence, Mass. . . . **Phillip Hartley Smith**, MTE '52, writes: "In conjunction with the Australian Consul General, we have formed the American Australian Council Chamber of Commerce, based in Pittsburgh, Penn., to further business, technical, and scientific liaison on a bilateral basis."

. . . **Charles D. Himmelblau**, MAE '75, writes: "I am working on Space Station materials and processes selection. The major technical issues are materials' resistance to vacuum, radiation, atomic oxygen, and ammonia (in the cooling system). I am also general chairman of the committee organizing the 1991 Golden Gate Materials Technology Conference in San Francisco (presentation offers cheerfully accepted)." . . . **Jack H. Westbrook**, ScD '49, president of Sci-Tech Knowledge Systems, Inc., Scotia, N.Y., has been reappointed chair of the William Hunt Eisenman Rare Book Committee of ASM International. The purpose of the committee is to develop and promote the awareness of an assembly of rare books, manuscripts, and notebooks that have influenced the development of materials science and engineering.

James M. Blackwood, SM '42, of Bethlehem, Penn., died on September 13, 1989, after a long illness. He was a ceramic engineer for 15 years at Bethlehem Steel Corp. before retiring in 1970. Prior to that he worked for Carborundum Co., Niagara Falls, N.Y., for 15 years. He was a member of several organizations including the American Ceramic Society. . . . **Herbert H. Anderson**, ScD '53, of Naperville, Ill., died on June 8, 1989. No further information was provided.

IV ARCHITECTURE

Rai Y. Okamoto, MAR '51, was appointed a member of the San Francisco Arts Commission in January 1989. He continues as vice-chairman of the State Historic Capitol Building Commission. Okamoto is preparing an urban design plan for the city of Compton, Calif. . . . **Marc A. Maxwell**, MAR '85, writes: "During the past year I have given a talk on Sick Building Syndrome at the BSA Build Boston '89 trade show and had an article published in the *Retirement Housing Reporter* on Design Review for Seniors Housing."

. . . **Leah Greenwald**, MAR '78, is the proud mother of boy triplets born October 3, 1989. Their names are Bren, Gideon, and Jacob Cavallo. She writes: "I am thus temporarily retired from my own ar-



G.E. Wohl

B.K. Ederly

chitecture practice (which I may not resume until the next millennium). We are moving to an 1898 house in Cambridge, Mass., to accommodate our exploding household! The house needs enough architectural services to keep me quite busy until I go public again."

. . . **Joyce C. Wang (Tien)**, MCP '61, as a co-principal investigator at Old Dominion University in Virginia, has been working on a Geographic Information System project for Portland, Ore., funded by USGS since early 1989. Her two sons, Frank and Mark, are writing their doctoral theses at MIT. Her only daughter, Cindy, entered Harvard Medical School last fall, after graduating from MIT in the spring of 1989. During the summer of 1989, Wang was invited by the National Economic Development Commission in Taiwan to lecture in workshops on the Geographic Information System's applications to local governments.

Stanley Moss, MCP '64, has graduated from the University of Massachusetts at Boston with a master's degree in history and archival methods. His thesis was entitled "The Documentation of the Southwest Corridor Project." He is a consultant in historic preservation planning with Boston Affiliates, Inc., and is a member of the Boston Landmarks Commission. . . . **Rex M. Ball**, MAR '58, is CEO of HTB, Inc., in Oklahoma City, Okla. The architectural, engineering, and planning firm has recently relocated its headquarters to a historic Presbyterian Church site. Instead of razing or renovating the old church, which was built in 1907, the firm has left the old structure as a ruin, surrounding it on two sides with a new building and an atrium in between. . . .

Francesco Passanti is the first holder of the Clarence H. Blackall Career Development Professorship in Architectural History. The appointment is for two years. The chair was established with a bequest from the estate of **Robert M. Blackall**, '17. Passanti came to MIT in 1987 as an assistant professor of the history of architecture in the Department of Architecture's Program of History, Theory, and Criticism.

The Boston Society of Architects (BSA) recently elected **Richard J. Bertman**, '60, as vice-president/president-elect. Bertman, a partner and principal-in-charge of design at CBT/Childs Bertman Tseckares & Casendino, Inc., is currently a member of the Boston Landmarks Commission and chair of the Design Review Committee. Bert-

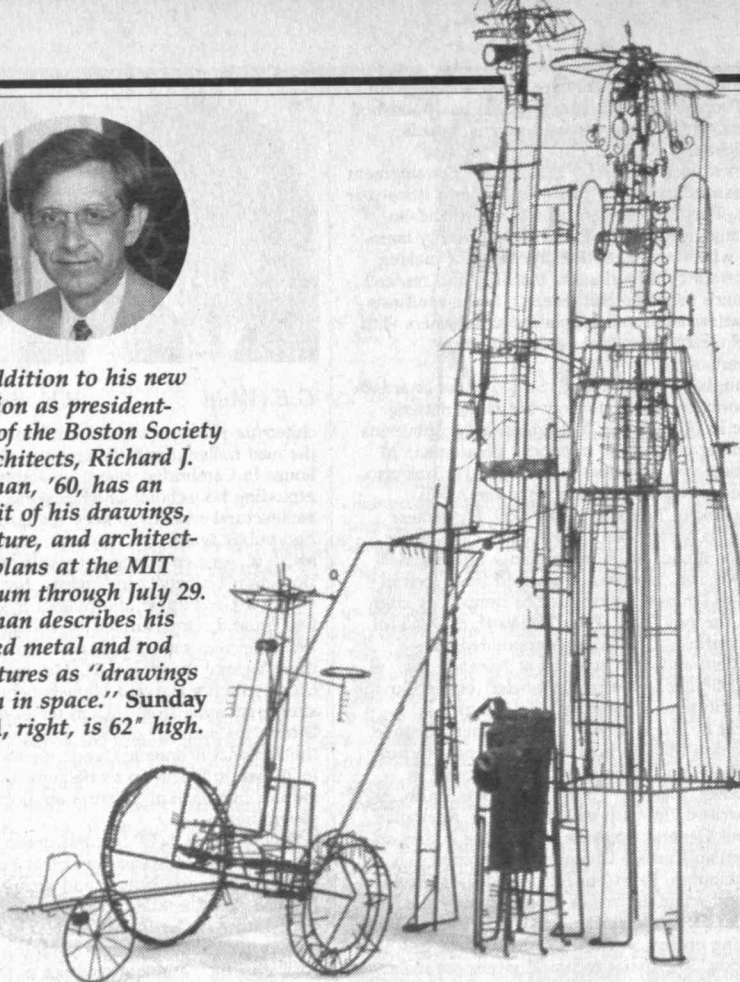


W.C. Spears

D.J. Dyer



In addition to his new position as president-elect of the Boston Society of Architects, Richard J. Bertman, '60, has an exhibit of his drawings, sculpture, and architectural plans at the MIT Museum through July 29. Bertman describes his welded metal and rod sculptures as "drawings frozen in space." Sunday Stroll, right, is 62" high.



man is a former assistant professor at the Rhode Island School of Design and has taught at the Boston Architectural Center, Harvard, MIT, and Tuskegee University. . . . Many new announcements at Arrowstreet, Inc., of Somerville, Mass: Paul R. Farrell, MAR '79, John K. Felix, MAR '86, and Garet E. Wohl, MAR '86, have all been named as new associates of the firm. Daniel J. Dyer, MAR '84, Brad K. Edgerly, MAR '83, and William C. Spears, '76, are new principals with Arrowstreet. Current local projects for the firm include CambridgeSide Galleria, the largest development in the history of Cambridge and a mixed-use complex in the Longwood Medical area of Boston which combines medical offices, parking, retail, and day-care.

(Benjamin) Frank Smith, MAR '68, of New York, N.Y., died suddenly of an apparent aneurysm while on vacation in Jamaica on January 15, 1990. Smith joined the Alumni/ae Association as regional director of New York in 1981 and was promoted to senior regional director in 1988. He spent two years in architecture in the Boston area before going to Spain on a Fulbright-Hays

Scholarship in 1970-71. He worked in the School of Architecture and Urban Design at the University of Kansas and was appointed assistant dean and assistant professor at the School of Architecture at Tulane University. Smith also served as director of Tulane's Office of Alumni Affairs. . . . **Richard L. Steiner**, MCP '39, of Baltimore, Md., died on December 13, 1989. He was involved in urban renewal policy for Baltimore, directing the city's Redevelopment Commission. In 1967 he worked as consultant to the secretary of Housing and Urban Development, then became a professor of city planning at Howard University. Steiner later became a professor of social work and community planning and eventually the assistant for planning to the chancellor of the University of Maryland at Baltimore.

V CHEMISTRY

Beverly A. Pawson, PhD '66, left Cytogen Corp. of Princeton, N.J., to join Berlex Laboratories, Inc. Berlex is a wholly owned subsidiary of Schering AG in Berlin. . . . **John T. Viola**, PhD '67, writes: "I am deeply involved with the development of Infrared Focal Plane Arrays by the growth of HgCdTe by Metal Organic Chemical Vapor Deposition (MOCVD) at the Rockwell Science Center in Thousand Oaks, Calif. The work is progressing well." . . . **Thomas E. D'Ambra**, PhD '83, joined Coromed, Inc., a new company specializing in the discovery and development of cardiovascular therapeutics, as vice-president for chemistry. . . . **Jim Bier**, PhD '71, is chairman-elect of the Virginia Blue Ridge Section of the American Chemical Society. . . . **David A. Ucko**, PhD '72, was appointed president of the Kansas City Museum in Kansas City, Mo. A new science museum is being built to complement the existing facilities.

Timothy P. Curran, PhD '88, is a research scientist at Alkermes, Inc., of Cambridge, Mass. . . . **Evan T. Williams**, PhD '63, writes: "I have been appointed dean of Undergraduate Studies at Brooklyn College, CUNY, after 24 years of teaching and research in the Chemistry Department. I am responsible for all undergraduate programs at the college."

John W. Thoman, Jr., PhD '87, assistant professor of chemistry at Williams College in Williamstown, Mass., has received a \$27,800 Cottrell College Science Grant from Research Corp. to support his research on photo-dissociation dynamics. Thoman and his students will examine the photochemistry of simple, gas-phase freon molecules to probe both how chemical bonds are broken and the role of "free radicals" that form from breaking bonds play in various chemical phenomena.

James J. Burke, PhD '62, has been named a senior fellow in Monsanto Co.'s program to recognize those individuals making significant, continuing technical contributions to the company and to their specific disciplines. A fellow in the New Technology Development group of corporate research, Burke is responsible for research programs on synthetic polymers for biological applications in cell culture, bioseparations, controlled delivery, and exploratory probes. Among his accomplishments are artificial stadium and sport surfaces, nonwoven geotextile fabrics, gas separation fibers, hollow metal fibers, and hollow fiber membranes for biological applications. . . . **Ashland Chemical, Inc.**, of Columbus, Ohio, has named **Gary L. Smith**, SM '80, business development specialist. Smith will provide marketing support for new products and evaluate and develop new business opportunities for the company's operating divisions.

VI ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Robert Moore, PhD '71, is the president of Gen-sym Corp., a software company that has provided the G2 Real-Time Expert System for over 300 applications. He reports that a number of other MIT alumni/ae are part of the Cambridge-based company. . . . "In September, I joined the North Texas Commission as executive vice-president," writes **Dean Vanderbilt**, PhD '70. . . . **Diarmuid O Mathuna**, PhD '80, is an associate at the School of Theoretical Physics at the Dublin Institute for Advanced Studies, Dublin, Ireland. Mathuna published *Mechanics, Boundary Layers, and Function Spaces* (Birkhauser/Boston Inc.) in October, 1989. The book jacket states: "This work is primarily aimed at clarifying the precise significance of two-dimensional theories of plates and shells within the framework of the three-dimensional linear theory of elasticity. [It] will be a valuable resource to all applied mathematicians and mechanical engineers working in structural mechanics."

Jon Doyle, PhD '80, writes: "I accepted Jesus Christ as my savior on Dec. 25, 1988, and married Carol Kiely of Newton, Mass., on July 15, 1989. I work as a research scientist in MIT's Laboratory for Computer Science and was recently elected chair of ACM SIGART."

Stanley Lapin, SM '47, is president of the St. Thomas & San Juan Telephone Co., a facilities-based long distance telephone carrier operating a satellite earth station in the Virgin Islands. . . . **Mark A. Tubinis**, SM '83, of Reading, Mass., was married in June 1988 in Kenosha, Wisc. In the same month he was made director of engineering at Summa Four, Inc., located in Manchester, N.H. Since October 1989, Tubinis has been vice-president for engineering at Summa Four. . . . *Mass High Tech* ran an executive interview with **David Perozek**, EE '67, in the Jan 1-14, 1990 issue. Perozek is general manager of Apollo Systems Division, a wholly owned subsidiary of Hewlett-Packard. The interview discussed the recent merger of Apollo with Hewlett-Packard and out-



P.R. Farrell



J.K. Felix

lined some of Perozek's plans for the future of Apollo. . . . **William C. Wilder**, EE '68, was promoted to department head in D91 at Mitre. Wilder joined the company in 1972 and most recently has worked as project leader for the Universal Modem program.

Two MIT Course VI assistant professors have been appointed to Career Development Chairs. **Srinivas Devadas** has been named to the Analog Devices Career Development Professorship for a two-year term. He joined MIT in 1988. His principal fields of interest are all aspects of synthesis of VLSI circuits, including optimization techniques for synthesis at the logic, layout, and architectural levels. **Glenn Rennels** has been selected for a Thomas D. and Virginia W. Cabot Career Development Professorship for a three-year term. The chairs were established by the Cabots in the fields of engineering and molecular or cell biology to recognize excellence in teaching and research by gifted young faculty members. Rennels joined the MIT faculty in July of 1989 as Thomas Cabot Assistant Professor of Computer Science and Engineering. Previously, he was both a resident in the Department of Anesthesiology and a research affiliate in medical computer science at the Stanford University School of Medicine. He has an MD from Dartmouth and a PhD in medical computer science from Stanford.

VI-A INTERNSHIP PROGRAM

It is with great sadness of heart that I report the death, on February 6, 1990, of **Richard B. Adler**, '43, graduate and longtime supporter of the Department's VI-A Program. Adler was struck by a car about 6:00 AM while on his regular jog near his home in Concord, Mass. He died several hours later after having been flown by helicopter to the University of Mass. Medical Center in Worcester. Dick was 67 years old.

Adler served as Course VI's associate department head for Electrical Science and Engineering from 1978 to 1989. VI-A was under his purview during this time and, as VI-A Director, he was the person with whom I had the closest contact. VI-A experienced its greatest growth to date in that period, due in large measure to his foresight, guidance, and support.

A "Ceremony of Remembrance" was held on February 12, 1990, at which some 800 friends, colleagues, and students gathered in Kresge Auditorium to pay him tribute. I was honored to be one of the ushers at this gathering. A reception for the family followed in the Stratton Student Center. **Daniel L. Smythe, Jr.**, SM '64, of Lincoln Laboratory, was a VI-A grad who spoke to me at the reception.

VI-A has lost a distinguished graduate and a true believer in the role the Program plays in the Course VI curriculum! He leaves a great void and will be sorely missed.

The story of the VI-A Program and its effect on engineering education is the basis of an article by W. Bernard Carlson (University of Virginia), which has earned him the IEEE Life Members' Prize in Electrical History. Appearing in *Technology And Culture*, July 1988 issue, the article is entitled "Academic Entrepreneurship and Engineering Education: **Dugald C. Jackson, Jr.**, SM '22, and the MIT-GE Cooperative Engineering Course, 1907-1932."

The citation states, in part, that Carlson "combines thorough historical research with illuminating analysis of an issue of major contemporary importance: how to educate engineers in an industrially competitive world. He focuses on the MIT-GE Cooperative Engineering Course and the efforts of the course's creator, **Dugald C. Jackson**, to illuminate the transformation of the U.S. engineering profession in the early 20th century."

VI-A alums continue to leave their mark on the development of the profession. **Andrew J. Viterbi**, SM '57, for instance, has been awarded the

16th Marconi International Fellowship "for his achievements in the field of digital communications in many adverse environments, particularly through his widely used algorithm"—which he conceived. It has aided in receiving signals from deep space and in many other types of communication. He is a cofounder of Linkabit Corp., which was later acquired by M/A Com., Inc. He then went on to start his present company, Qualcomm, Inc., of San Diego, Calif., which develops communications systems.

Allan C. Schell, SM '56, who had been with the Air Force Cambridge Research Laboratories (AFRL) in Bedford, Mass., for twenty years, became chief scientist of the Air Force Systems Command in 1987. At the time I became VI-A Director, in 1969, AFRL was a participant in the VI-A Program. I note from the IEEE Boston Section's *The Reflector* that Schell will be addressing their Professional Awareness Committee for Engineers (PACE) meeting February 8, 1990.

A quite different item relates to **Stuart E. Madnick**, SM '69, on the faculty of our Sloan School of Management. Stuart owns Langley Castle in Northumberland, England, where he played host to an exiled king and queen, Michael and Anne, of Romania. Since 1986 Stuart has operated his castle as a luxury hotel. His academic interests lie in the management implications of information technology and large database systems.

As I write this, mid-February, the VI-A selection process for the new class of '90 is under way. Director O'Toole delivered the orientation lecture on February 7, to 130 students in Edgerton Hall. The student-run open house comes next, on Feb. 14, and the company representatives will be on campus March 5-7 for the annual dinner, open house, and interviews.

It is anticipated that this year's incoming class will number about 87. New this year will be internships with the Consortium for Superconducting Electronics. This Consortium was recently founded by MIT, MIT's Lincoln Laboratory, IBM Corp. and AT&T, to develop technology leading to applications of superconducting electronics. Students will be selected for specific assignments with AT&T, IBM, or Lincoln Labs.

At MIT for regular senior recruiting and expecting to return for Bellcore's VI-A recruiting, were **Chester M. Day, Jr.**, SM '58, **Neil M. Haller**, SM '59, and **Steven L. Rohall**, SM '88. We all had a grand "Bell System" reunion over lunch at Legal Seafood (yours truly worked at Bell Labs prior to coming to MIT).

Eric A. Martin, SM '85, and **Barbara K. Moore**, SM '86, came to visit and have me endorse their Engineer in Training (EIT) applications in preparation for qualifying for their Professional Engineer licenses; something more graduates should consider at the start of their careers as the procedure is much simpler then.

I mentioned in my last article that I'd postpone acknowledging '89 Xmas cards from VI-A's 'til my next writing; so here's the alphabetical list: **Geoffrey J. Bunza**, SM '77, & family; **John D. Chisholm**, SM '76; **John F. Cooper**, SM '76, & wife; **Edward C. Giaimo**, SM '75; **Cecil H. Green**, SM '24; **Michael A. Isnardi**, SM '83, & wife; **Lawrence Kernan**, SM '78; **David L. Lyon**, SM '70; **Vincent H. Tobkin**, SM '73, & family; and **Richard D. Wesel**, SM '89. Others came from company people I've known over the years, plus some regular Course VIers. It's wonderful to get these annual remembrances with their thoughtful notes.—**John A. Tucker**, Director (Emeritus), MIT, 77 Mass. Ave. Rm 38-473, Cambridge, MA 02139

VII BIOLOGY

Leonard P. Guarente, '74, has been selected for a Thomas D. and Virginia W. Cabot Career Development Professorship for a three-year term. The chairs were established by the Cabots in the fields of engineering and molecular or cell biology

to recognize excellence in teaching and research by gifted young faculty members. Guarente joined the MIT faculty as an assistant professor in 1981 and was promoted to associate professor in 1985. His research program concerns the mechanisms for regulating gene expression, for which he has achieved wide recognition. He was the holder of a five-year (1984-89) presidential young investigator award.

The Alumni/ae Association was notified that **Julia C. Sullivan**, MPH '42, of Boston, died on March 19, 1988. No further information was provided.

VIII PHYSICS

Major **James F. De Broux**, SM '79, writes: "Life in Europe is quite interesting with all the recent events in Eastern Europe. I am in my second year as executive officer of the 570th Artillery Group supporting British and Belgian artillery units. I was recently selected for promotion to lieutenant colonel. We will leave Germany in August 1990, but I have no word on my next assignment." . . . **Melvin Lax**, PhD '47, writes: "After eight years at Syracuse University and achieving the rank of professor (of physics), I left to do full-time research at AT&T Bell Labs. I spent 17 years there, two as head of the Theoretical Physics Research Dept. I then returned to teaching as distinguished professor of physics of the City College of New York, City University of New York in 1971. I remained a consultant to Bell Labs. In 1983 I became a member of National Academy of Sciences. Along the way, Judy and I have raised four children who are pursuing a variety of careers in clinical psychology, merchant banking, music, and law."

Robert A. Rapuano, SM '47, of Marion, Mass., died on November 12, 1989. A physicist, he joined the staff of MIT's radiation lab in 1944. He followed a career in military electronics, helping to develop microwave devices used in communication satellites and radar while working at Raytheon Corp., Mitre Corp., and other facilities. Most recently, Rapuano retired from IIT's Felec Services of Colorado Springs as a consultant in their radar testing system. He was a member of Sigma Xi and Sigma Pi Sigma.

IX BRAIN AND COGNITIVE SCIENCES

MIT's Department of Brain and Cognitive Sciences will receive \$1.2 million over three years as part of a \$12 million foundation award for studies of brain processes. MIT will use the award to set up a Cognitive Neuroscience Center within Course IX. Associate Professor **Richard A. Andersen** will be the director of the program. The grant will support five graduate students and five postdoctoral fellows. The Department will offer new core courses to serve graduate students, and will require that their doctoral research be supervised by faculty in at least two of the three fields of cognitive science, neuroscience, and computer science. The **James S. McDonnell** [SM '25 (XVI)] Foundation of St. Louis and the **Pew Charitable Trusts** of Philadelphia announced the awards last month under the McDonnell-Pew Program in Cognitive Neuroscience.

X CHEMICAL ENGINEERING

Timothy J. Donnelly, PhD '89, is a process development engineer for Rohm and Haas. . . . **Herbert L. Stone**, ScD '53, writes: "I retired from Exxon in October of 1988, after 35 years in research. During 1989 I formed Stone Engineering, a consulting firm specializing in reservoir engineering and simulation. My current clients

include British Petroleum and a local legal firm, Andrews Korth." . . . **William K. Fraizer**, SM '80, recently transferred to Chevron's Denver production office as senior gas & chemical engineer, after completing an assignment as acting engineering supervisor of the Gaviota Oil & Gas Plant in Santa Barbara, Calif. "The plant was successfully commissioned," writes Fraizer, "but was unable to start up due to political delays." . . . From Oakland, Calif., **Joseph E. Leitgeb**, SM '57, reports: "For the last six years I have served as manager of human resources for Chevron Research Co. in Richmond, Calif. It was a pleasure this past year to help set up a chemical engineering practice-school station at our site. The program went very well with both MIT and Chevron mutually benefiting from the experience. We look forward to having the next group work here in the summer of 1990." . . . **Leo Maas**, SM '40, is president of MMASCO, a business acquisitions & mergers firm. Maas is active in the MIT Real Estate Club of Southern California.

Vernon O. Bowles, SM '33, writes: "My wife Dolores and I keep well and enjoy our lifestyle in Naples, Fla. We play golf at the Country Club of Naples about two or three times each week, and enjoy social and duplicate bridge once or twice each week. I operated a DHW solar business from 1978 until SOLARTRAP, Inc., was dissolved in 1985. All units in Naples and on Block Island, R.I., continue to be operational and I service them from time to time as needed. For about 10-12 years we summered on Block Island until three years ago when we sold our properties there and became year 'rounders' in Naples. We enjoyed travels to Cornwall, Devon, Punta Arenas, Cape Horn, and the Falklands in 1988." . . . **John L. Espy**, SM '47, writes: "I have recently retired from my position as professor of international business at the Chinese University of Hong Kong and am now settled in Topeka, Kansas. . . . *Computer Graphics: The Principles Behind the Art and Science* (Franklin, Beedle & Assoc.) is a new book by **Curtis F. Gerald**, ScD '41, of California Polytechnic State University, San Luis Obispo, and **Cornel K. Pokorny**.

W(averly) Quentin Smith, SM '34, of Reston, Va., died on December 1, 1989. He was a retired chemical engineer for Du Pont and a member of numerous fraternities, commissions, and associations. . . . The Alumni/ae Association has been notified of the deaths of **Anthony C. Yeung**, SM '73, of Bangkok, Thailand, in January 1987 and **Benjamin T. Woodruff**, SM '36, of Charleston, W. Va., November 3, 1989. No further information was provided.

XI URBAN STUDIES AND PLANNING

Bill Johnson, SM '86, has been promoted to manager of the Development Management Division of the Los Angeles County Community Development Commission. . . . **Philippe E.G.T. Annez**, PhD '81, is now chief of the World Bank Resident Mission for Thailand and Indochina in Bangkok. . . . **Stephen T. Johnson**, MCP '88, writes: "I was recently hired by the Massachusetts Executive Office of Environmental Affairs to serve as director of land planning. In this capacity I will coordinate all land conservation and recreation planning activities of the five environmental agencies in Massachusetts. I will also oversee development of new information management systems for land planning, including extensive use of geographic information systems." A note from **Francis T. Ventre**, PhD '73, says: "Three classmates are now together at Virginia Tech in the Department of Urban Affairs and Planning (known as 'Doo-Wap'). All three were involved in the turbulence for which the 60's were notorious. **Mike Appleby**, PhD '68, is a coordinator of university participation in Tech's institutional planning effort and an adjunct professor. **Anna Hardman**, MCP '71, is assistant professor (in a joint program with economics).

I'm a professor and teach in architecture where I address issues in regulation and building performance. Am still living off my thesis!" . . .

Edwin J. Melendez has been chosen as one of two holders, for a two-year term, of the Mitsui Career Development Professorship. The second holder will be named shortly. The chair was established in 1980 through the generosity of the Mitsui Group, one of the oldest and largest industrial organizations in Japan. The fundamental objective of the professorship is to encourage cultural and technological exchange between the United States and Japan. Melendez was assistant professor of economics and Puerto Rican studies at Fordham University from 1984 to 1986, when he became an assistant professor of political economy and urban studies at MIT. He received a teaching award from the Graduate Student Council in 1988. In 1988-89 he was a National Research Council and Ford Foundation postdoctoral fellow at Hunter College, City University of New York.

XII EARTH, ATMOSPHERIC, AND PLANETARY SCIENCES

Andre Kermabon, SM '56, writes: "I am the president/founder of SYMINEX, in Marseille, France, with subsidiaries in Norway and Great Britain. After an initial specialization in the field of measurements of the dynamic behavior of offshore platforms, the company has now become a leader in France in the development of real time data acquisition systems applied to defense, aeronautics, space, and automotive industry. We are great users of U.S.-made computers: Masscomp, Alliant, etc., which are parts of our integrated systems. The company now also has a line of products ranging from data acquisition and signal processing hardware to standard application software. We believe that we are leaders in the field of vibration and acoustical analysis, vibration testing, rotary machinery, shaker control, and modal analysis. I am now 58 and have two children: **Christophe**, 23, will graduate in mechanical engineering in September 1990. He wishes to enter grad school at MIT in 1991. My other child, **Michaela**, 30, is a secretary in my company. Every year we spend our summer vacation in our apartment in Vienna. My wife **Sigrid** is Austrian born, as are my two children."

Grant Buma, SM '70, has opened a new environmental consulting office in Salt Lake City, Utah, for Kleinfelder. . . . **Maurizio Fantini**, PhD '88, is employed by FISBAT-CNR, a research institution in Bologna, Italy. . . . **William C. Corea**, PhD '81, was appointed senior geologist at Chevron Exploration & Production Services in Houston, Tex.

Steven Ostro, PhD '78, who works at the Jet Propulsion Lab (JPL) in Pasadena, Calif., heads a team of radar astronomers who recently discovered an asteroid that passed within 2½ million miles of Earth in August. The asteroid, named 1989 PB, is an irregular double body approximately a mile wide, rotating in a propeller-like motion every four hours. Ostro's radar images of one asteroid are the first to be taken of such a small body, albeit a double body. Ostro is one of only a dozen radar astronomers in the world today. He has been an astronomer for the past 15 years, and with JPL for the past 5 years.

Thomas A. Herring, PhD '83, was named to the Kerr-McGee Career Development Professorship for a three-year term. The professorship is for a faculty member in Course XII, preferably one working in petrology or geophysics. Herring was chosen because of his research in space geodesy. His specialty concerns the precise measurement of positions on the earth's surface and deformation of the earth's surface.

XIII OCEAN ENGINEERING

A brief note from **Daniel Hunt**, SM '48, reports that he is "retired in Annapolis, Md." . . . Commander **R.A. Schwarting**, OCE '83, USN, writes: "I recently acted as project officer for two months of the dry-docking availability of Commander Sixth Fleet Flagship, USS *Belknap* (CG-26) in Toulon, France. *Belknap* went on to host President Bush during the Malta Summit. . . . **William W. Rogalski, Jr.**, SM '70, reports: "In October of 1989 I was promoted to division head of the Gibbs & Cox, Inc., Washington division. I am also serving as chair of the Chesapeake Section of the Society of Naval Architects and Marine Engineers for the 1989-1990 fiscal year. . . . Word from **William D. Needham**, OCE '86, of Aiea, Hawaii, is that he is currently assigned as force material officer for the Commander of the U.S. Pacific Submarine Force. He completed the requirements for designation as a PE in the State of Virginia. Needham published an article in *Naval Engineer's Journal*; "Bottom Bounce Array Sonar Submarine" (Sept 1989).

George Uberti, SM '54, writes: "I have retired after 21 years at the National Steel and Shipbuilding Company (NASSCO)." . . . **David Hui**, SM '82, called our offices to let us know about the following awards he received: Fellow of the ASME, Associate Fellow of the AIAA, and Associate Fellow of the Canadian Aeronautics and Space Institute.

Rear Admiral **Ernest C. Holtzworth**, SM '36, USN (Ret), died on May 15, 1989. He served as head of the War Analysis Branch of BuShips during WWII. In 1945 he was appointed as professor of naval construction at MIT where he directed the 13A program. Subsequent assignments included command of both the Pearl Harbor and New York Naval Shipyards. He retired from the Navy in 1964.

XIV ECONOMICS

Nicholas S. Perna, PhD '69, was recently promoted to senior vice-president & chief economist at Connecticut National Bank. . . . **Jaleel Ahmad**, PhD '65, who is living in Montreal, Quebec, writes: "I taught a graduate course on open economy macroeconomics in the spring of 1989 at Fudan University in Shanghai, Peoples Republic of China, under the auspices of the Ford Foundation and the NAS. . . . **Juan Antonio Poblete**, SM '69, is president of Ingeniera de Gestion Ltda. in Santiago, Chile.

Clair A. Peterson, PhD '61, of Junction City, Calif., died on June 12, 1988. Peterson's doctoral studies were interrupted by a tour of duty as an air intelligence officer with the U.S. Navy. This duty was followed with employment as an employee relations specialist with Standard Oil of New Jersey. Peterson then served as director of research at the Bureau of Labor Management at the University of Iowa. Two years later he was associate professor of economics and operations analysis at the U.S. Naval Postgraduate School in Monterey, Calif. Peterson retired from government service in 1985 and moved to Junction City, where he was active in various organizations.

XV MANAGEMENT

Katherine Novicki Green, SM '78, writes: "I am currently teaching in the Information Systems Department of Bentley College in Waltham, Mass. I have two daughters: **Kaitlin**, 5, and **Madelaine**, 2." . . . **Stanley C. Abraham**, SM '68, reports: "I am no longer a professor at Pepperdine University, but president of my own consulting firm, Future by Design. My second son, **Jason**, brother to **Mark**, was born on April 27, 1988. . . . **Maurice Olivier**, SM '79, is leading Arthur D. Little's European Strategy and Organization Practice. He also

has been elected chair of Belgium's Management Consultants Association. . . . From San Diego, Calif., **Anita M. Kirkpatrick**, SM '85, writes: "I am looking forward to completing my law school studies in December 1990." . . . **Michael D. Smolinski**, SM '76, sends word: "I have joined Tucker Anthony Inc., in Boston, as vice-president responsible for energy industry research. I've spent the last 13 years with DRI/McGraw-Hill, the economic consulting firm, forecasting the energy markets."

In June 1988, **Walter R. Menning**, SM '70, was appointed vice-chair of Information Systems for the Mayo Foundation in Rochester, Minn. . . . From Brussels, Belgium, **Val C. Grandis**, SM '54, writes: "I have just been seconded as a member of C.E.C. (Commission of the European Communities) at the Eureka Secretariat, where I am in charge of information technology & telecomm—'Eureka' is the Pan-European initiative in collaborative applied R&D that has launched some 300 projects in nine high-tech areas. I was formerly head of the 'Esprit' program evaluation, then counsellor for organization at the 'Esprit' Directorate of the Commission of the European Communities in Brussels." . . . **Nariman M. Deboo**, SM '69, is vice-president in the Finance Department of American Express Bank. In addition to annual and strategic planning and financial analysis, his responsibilities include overseeing the risk management program at this international banking subsidiary of the American Express Co. . . .

Paul R. Freshwater, SM '68, is the regional manager of public affairs for Procter & Gamble in Cincinnati, Ohio, covering 12 southeastern states plus Puerto Rico. He is active in the Charter Committee of Greater Cincinnati and Sea Explorer Scouts.

Walter J. Popper, SM '83, was recently promoted to vice-president at Index Group. Popper will be consulting on business strategy and organizational restructuring. . . . **Robert Cayleff Weiss**, SM '74, was named manager of supply operations at Amerada Hess Corp., in January 1988. . . .

Michael DeMarco, SM '68, is working in equity investing for Citicorp, specializing in Europe and Asia. . . . **James F. Reda**, SM '83, reports: "My wife Susan will graduate from Brooklyn Law School in June 1990." . . . **Richard F. Manhardt**, SM '86, writes: "I have recently been promoted to manager of subassembly for the AH-64 Apache Helicopter at McDonnell Douglas Helicopter Co. in Mesa, Ariz. My wife Terry and I are the proud parents of Catherine, born April 4, 1989." . . . **Paul R. Jandreau-Smith**, SM '86, was promoted to manager of integrated marketing at Y&R, Inc., last fall. He has world-wide responsibility for integrating communications for Y&R companies.

Huntington Lambert, SM '85, writes: "I am director of market strategy development for USWEST Strategic Marketing. Call if you are coming through Denver!" . . . **Steven Russell Kanner**, SM '74, reports: "I have just completed developing a physician's business and clinical management system which runs on the Mac II. It is qualitatively different from anything available." . . . From Framingham, Mass., **Jane Hagen**, SM '81, sends word that she founded a new management consulting firm called Information & Technology Strategies. . . . **Giyora (Guy) Doeh**, SM '58, writes: "This has been a landmark year. After ten years of operation, on June 1, 1989, the company of which I am president went out of the Century 21 franchise system and is now called West LA Realty, Inc. It has also been my most profitable year thus far. I would certainly welcome alumni/ae contacts regarding real estate activity (anywhere in the U.S. as I do extensive referral work)." . . . **Dean L. Wilde, Jr.**, SM '80, serves on the Strategic Planning Associates Policy Committee. Wilde is executive vice-president leading the telecom and technology practice.

Michael J. Henderson, SM '85, writes: "Emily, our second child, was born in November. We're planning a late winter visit to **David Dubbin**, SM '85, in Boca Raton, Fla. It will be a welcome reprieve from Corning, N.Y., weather. Dave trans-

ferred from Boston to Florida in October of 1988. He is still with Motorola. . . . **William A. Gillett**, SM '85, reports: "I began my fifth year at American Express working on a long-term information systems project to integrate our customer-support systems worldwide. I find myself having fun splitting my time between New York City, Phoenix, Ariz., and the rest of the world." . . . **Glenn T. Migliozi**, SM '86, is "working for Aetna Life & Casualty as a director in the Corporate Finance Department. Lynn and I are proud to announce the birth of our daughter Cara on May 10, 1989." . . . **Robert Lensch**, SM '83, writes: "I moved to Madrid, Spain, last May. Still with Dow Chemical, I manage information systems development for the Iberian region. Last July, **John Martin**, SM '83, visited while he was traveling through Europe. Further visitors who want to discover the country of the 1992 Olympiade and World Fair are always welcome."

From Cherry Hill, N.J., **David R. Zibbell**, SM '63, reports: "My company, Crown Textile Co., where I am the vice-president of finance, moved to new corporate headquarters in Blue Bell, Penn., from Jenkintown, Penn. My daughter, Miriam, a sophomore at the University of Pennsylvania, took a leave of absence to participate in a five-month national tour of *West Side Story* as an understudy for the part of Maria. . . . **Rabbi John D. Cooper**, '70, may be able to attend reunion activities this year. He refers to himself and his classmates as the "20-year survivors." . . . **Allan B. Cruickshanks**, SM '82, writes: "Linda and I moved back to Austin, Texas, from California last year. I am now the plant manager for Rolm in Austin where we manufacture telephones." . . .

Michelle F. Demarest, SM '79, has been promoted to treasurer of Charles River Associates. Prior to joining CRA, Demarest was an audit supervisor at Coopers and Lybrand. . . . **John H. Hubbard**, SM '63, has become vice-president of Coherent, Inc., in Sturbridge, Mass. He will remain president of Coherent General, Inc., also in Sturbridge. . . . **Pierre M. Loewe**, SM '70, has moved from vice-president to senior vice-president of the MAC Group in Cambridge, Mass. . . . **John F. Fort III**, SM '66, is a director of Dover Corp. in New York, N.Y. He will continue as chair, president, and CEO of Tyco Labs., Inc., in Exeter, N.H.

The Alumni/ae Association has received word that **Robert E. McCord**, SM '52, of State College, Penn., died on August 29, 1989. No further information was provided.

Sloan Fellows

From Denver, Colo., **Linda Laskowski**, SM '84, writes: "I am vice-president and general manager of the Information Provider Market for USWEST Communications. The company recently deployed a major information services gateway in Omaha, Nebraska." . . . **Carl D. Peterson**, SM '72, reports: "My third book has been published by McGraw-Hill. The title is *How to Sell Your Business: For More Money in Less Time with Fewer Problems*. It is based on my firm's five years of work preparing and offering businesses for sale." . . . **Oliver C. Boileau**, SM '64, is the new president and general manager of Northrop Corp.'s B-52 Division in Pico Rivera, Calif. Boileau had retired in May 1988, and came out of retirement to accept this position. . . . **Louisville Gas & Electric Co.**, of Louisville, Ky., has made some personnel changes. **Roger Hale**, SM '79, has been elected chair of the board. He was previously elected president and CEO last June. **David R. Carey**, SM '88, is vice-president of marketing and sales for the company. He was formerly the marketing director for AT&T's General Business Systems in Parsippany, N.J.

Robert B. Johnson, SM '59, died December 12, 1989. He worked in various managerial capacities for 25 years with American Optical Corp. of Southbridge, Mass., before serving as president for six years with the Pennsylvania optical division of ITEK of Reading, Penn. Johnson then be-

came president and COO of Camelot Industries of Lexington, Mass., an optical ophthalmic manufacturing firm, before retiring in 1982. For the past three years he maintained a winter residence in Fort Myers, Fla. . . . **Marvin G. Kirby**, SM '72, of Brookline, Mass., died on December 19, 1989. Kirby was vice-president for marketing at Prime Computer, Inc., in Natick, Mass. Before joining Prime in 1982, he was employed by IBM Corp. in various capacities for 28 years. . . . The Alumni/ae Association has received word that **Thomas J. Carroll**, SM '58, of Birmingham, Mich., died on July 23, 1989. There was no further information provided.

Senior Executives

Michael A. Grimaldi, '87, was promoted to Comptroller of the Oldsmobile Division of General Motors Corp. in February of 1988. In January 1990, he became general marketing manager for the Oldsmobile Division. . . . From Niedersachsen, Federal Republic of Germany, **Hanns-R. Oeser**, '76, writes: "I am the managing director of KEWA Kernbrennstoff-Wiederaufarbeitungstechnik GmbH. The company acts as consultants to nuclear spent fuel-, and waste-management and related fields (e.g., remote technology and environmental protection). KEWA has been internationally successful in technology transfer and adaptation of selected processes." . . . **James W. Wogsland**, '87, is a director of First America Bank Corp., in Kalamazoo, Mich. He continues as executive vice-president of Caterpillar, Inc., in Peoria, Ill. . . . **William C. Weitzel**, '74, is a partner with Cummings & Lockwood, a law firm in Stamford, Conn. He recently retired as senior vice-president of Texaco, Inc., after 23 years of service.

XVI AERONAUTICS AND ASTRONAUTICS

Frederick C. Gray, SM '61, writes: "I led studies of installation of the International Aero Engines (IAE) V2500 turbofan on MD-80 derivatives in 1984-86. It led to recent launch of MD-90/V2500 by McDonnell Douglas. I am currently a team leader in the MD-11 Propulsion Systems group at Long Beach. Expecting MD-11 first flight soon." . . . From Bethesda, Md., **Peter M. Bainum**, SM '60, writes: "I was elected chair of the International Astronautical Federation's (IAF) Astrodynamics TC and was appointed co-coordinator of IAF Congress Astrodynamics Symposium. I was re-elected vice-president of the International American Astronautical Society." . . . **Robert Weinraub**, SM '68, is the director of the U.S. Army Office of Low Observable Technology and Application.

In Darnestown, Md., **Marc L. Sabin**, ScD '73, is the vice-president for advanced development & technology at Fairchild Space Systems Division. . . . **James K. Marsteller**, SM '47, of Kirkwood, Mo., writes: "I retired in November from the Army Aviation Systems Command in my 50th year as an aerospace engineer. During that time I worked for the Air Force, McDonnell-Douglas, Martin-Marietta, Bell Aircraft, and Chance Vought, as well as the Army on nearly every type of heavier-than-air vehicle that gets off the ground. This included fighter and bomber aircraft, missiles, spacecraft, launch vehicles, lifting bodies, remotely piloted vehicles, and helicopters. On my last project I was the Army's lead engineer on the MH-47E helicopter for the special operations forces. An article that I wrote about it appeared in the July 1989 issue of *Army Aviation*. Alas, many of the aircraft I worked on are already in museums!"

Word from **James A. Blissit, Jr.**, SM '86: "From 1986-89 I was chief of science and technology, Foreign Technology Division, U.S. Air Force, located in Tokyo, Japan. Since 1989 I have been an E16 pilot and chief of plans, 496th Tactical Fighter Squadron, U.S. Air Force, located in West Ger-

many." . . . In Pasadena, Calif., **John L. Loch**, SM '89, sends word: "I am currently working in the Robotic Intelligence group at the Jet Propulsion Lab. I am developing planning and control software for autonomous planetary rovers. In my spare time I am developing a software package which I hope to market in 1990 and I'm also formulating ideas for robotic toys that exhibit a user-trainable behavior." . . . **Kiernan F. Ryan**, SM '90, has joined the GE R&D Center as an aeronautical engineer on the Research Technology Program. . . . **John I. Erdos**, SM '65, reports: "I am continuing as vice-president of General Applied Science Labs, Inc., (GASL) on Long Island, N.Y., following acquisition of the company in May 1989 by Aerojet, a division of Gen Corp. GASL is heavily involved in scramjet engine development for the national aero-space plane (X-30) program. I direct GASL's research activities in the high-hypersonic end of the flight spectrum."

XVII POLITICAL SCIENCE

In Goshen, N.H., **Deborah A. Stone**, PhD '76, writes: "I am a visiting professor at the Yale School of Organization & Management for one year—started January 1990. I am senior editor of a new journal of liberal political thought and policy analysis—*The American Prospect*." . . . **William E. Miller**, SM '70, is editorial director of Phillips Petroleum Co., in Bartlesville, Okla.

The Alumni/ae Association has received word that **Hugo Bosch**, SM '52, of The Hague, Netherlands, died on March 15, 1989. No further information was provided.

XVIII MATHEMATICS

Eleanor Wu, PhD '85, of Princeton, N.J., writes: "I have been with AT&T Bell Labs since 1985. My research has been in the area of computer hardware testing—specifically, built-in self-test strategies for large systems." . . . From Palo Alto, Calif., **Daniel Bobrow**, PhD '64, reports: "I am a research fellow at Xerox PARC. I recently became president of the American Association for Artificial Intelligence." . . . The first American Mathematical Society Award for Distinguished Public Service has been presented to **Kenneth M. Hoffman**, professor of mathematics at MIT and a member of the Mathematical Sciences Education Board, which he was instrumental in forming. The \$2,500 award went to Hoffman for "his outstanding leadership in establishing channels of communication between the mathematical community and makers of public policy as well as the general public."

XXI HUMANITIES

MIT Professor **Theo C. Theoharis** has been named to the Class of 1943 Career Development Professorship for a two-year term. The chair was established by the class in celebration of its 40th reunion to recognize innovative and imaginative teaching by gifted young faculty members who show exceptional promise of making important contributions to teaching and research. Theoharis was chosen for his outstanding contributions to undergraduate education and scholarship in literature. In 1984 he became assistant professor at MIT and was promoted to associate professor of literature in 1988. His major field is the history of dramatic literature and its relation to narrative. He also has a wide-ranging interest in literary modernism and its use of inherited or traditional religious and metaphysical notions of time, space, and selfhood, the point being to show that modernism is more traditional than hitherto suspected.

XXII NUCLEAR ENGINEERING

Joseph P. Franklin, SM '61, writes: "I retired from the U.S. Army in 1987 as major general, former chief of U.S. military in Spain. I founded my own business consulting company, Franklin S.A. My wife has a company providing cross-cultural training for business executives. Our companies are located in Madrid, Spain, and we live the majority of the year in that city." . . . From Antony, France, **Joseph Sasson**, SM '85, reports: "Since June 1989, I have been working as a senior computer engineer at IBM-France, focusing mainly on the domestic market such as the French Social Security." . . . From the same place in France, **Eric Sasson**, SM '87, writes: "In January 1990, I began a one-year MBA program at INSEAD near Paris. More important, I'm getting married July 1, 1990, and it makes me feel older."

John W. Keffer, SM '88, is a B.W.R. reload design engineer in the Nuclear Fuel Services Department of Commonwealth Edison Co., in Chicago, Ill. . . . News from **Mark F. Samek**, SM '78: "I am employed at Northeast Utilities as a supervisor in Generation Engineering Instrumentation and Controls. I have just returned from 10 days of scuba diving at Grand Cayman Island."

. . . **Robert P. Morgan**, NUE '61, was given a Distinguished Faculty Award from Washington University in St. Louis, Mo., in October 1989. The award was for "outstanding commitment to teaching and dedication to the intellectual and personal development of students."

Word from **Ioannis A. Papazoglou**, ScD '78: "In June 1988 I was elected director of the Institute of Nuclear Technology-Radiation Protection (INT-RP) of the National Center for Scientific Research 'Demokritos' in Athens, Greece. The INT-RP employs 80 persons working in R&D projects in four main areas: radiation protection, nuclear analysis techniques, mass energy transport, and industrial safety & risk. In addition, in September 1989, I was appointed to the board of directors of the Greek Atomic Energy Commission." . . . After working on nuclear and fossil power plants in 37 states and 3 countries for EG&G Idaho, EDS Nuclear, Impell Corp., and CE, **Larry Metcalfe**, SM '75, has decided to teach and offer private consulting in performance engineering and monitoring. Metcalfe resides in Huntington Beach, Calif.

The Alumni/ae Association has been notified that **Helge Christensen**, PhD '61, of Kongsberg, Norway, died on August 10, 1989. No further information was provided.

TPP TECHNOLOGY AND POLICY PROGRAM

Richard Kutta, SM '80, is the director of design and construction for the HSM Development Corp. in St. Louis, Mo., an owner-operator of health care and elderly living communities. Kutta is also the chair of the 5,500 member Ozark chapter of the Sierra Club. He, his wife Nancy, and his son Andrew reside in St. Louis.

Steven Izatt, SM '84, is president and CEO of IBC Advanced Technologies, Inc., a high-tech separations company based on molecular recognition technology.

Maher Kallel, SM '87, has returned to Tunisia and is working with Poulina/PAF as a systems engineer. He manages the introduction of computer-aided manufacturing and CA production management. Kallel also consults for the Institut Regional des Sciences Informatiques et Telecommunications.

Scott Pace, SM '82, is a space scientist for the U.S. Department of Commerce in Washington, D.C. . . . **William Tsai**, SM '88, works in the Sector Planning Division for the Council for Economic Planning and Development in Taiwan. . . .

Daniel E. Jones, SM '81, is working on the Korean Intelligence Support System in Korea. . . .

David Cheney, SM '83, has left the Congressional Research Service and joined the staff of the Council on Competitiveness where he is an assistant project director.—Richard de Neufville, MIT, Rm. E40-252, Cambridge, MA 02139

MANAGEMENT OF TECHNOLOGY PROGRAM

John A. Harrison, SM '83, is assistant vice-president at Parsons Brinckerhoff in Boston. He and his wife Bonnie and their two children, Geoff, 12, and Jamie, 9, are planning a move to Hingham, Mass., from Princeton Junction, N.J. . . .

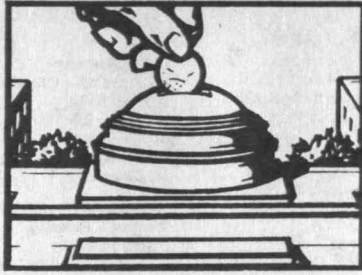
In July 1989, **John Hallal**, SM '85, was appointed manager of programs at GE Automated Systems Dept. in Burlington, Mass. He and his wife Lorna live in Chelmsford, Mass. . . . **H. Lee Task**, SM '85, is chief scientist with Armstrong Aerospace Medical Research Lab at Wright-Patterson Air Force Base in Ohio. Task has been at the job since October 1989. . . . **Rene V. Cormier**, SM '86, has been director of plans and programs since January 1989 at the Air Force Geophysics Lab at Hanscom AFB, Mass. . . . In October of 1989, **Glenn E. Nedwin**, SM '87, became vice-president of corporate development of the XOMA Corp., in Berkeley, Calif. . . . **Julia B. North**, SM '87, is vice-president for marketing at Southern Bell in Atlanta, Ga.

Anthony J. Ratkowski, SM '87, is the branch chief of the Geophysics Lab in the Optical/Infrared Technology Division of the Atmospheric Backgrounds Branch at Hanscom AFB, Mass. . . . **R. Eric Schmidt**, SM '87, has been promoted to lead a startup venture within Varian Associates Instrument Group in Walnut Creek, Calif. as operations manager. He has been in contact with fellow MIT alums: **Ginny Moszkowicz**, SM '87, **George Sonoda**, SM '87, and **Karen Simms**, SM '87. Schmidt and his wife Lorraine and their son Connor, 14 months, are expecting a new addition to the family in August.

Karen Simms, SM '87, has been manager of process testing and development at Cambridge Bioscience Corporation since the fall of 1989. . . . **Patrick B. Moran**, SM '88, is manager of Optoelectronics Engineering at IBM Corp. in Poughkeepsie, N.Y. . . . **Larry A. Seese**, SM '88, has recently become director of technology development with AT&T in the Network Services Division in Bedminster, N.J.

Akio Mitsufuji, SM '89, is group leader of North American Business and Chemical Group, Project Department, Industrial Systems Division of Toyo Engineering Corp. He was assigned to this division to make the most of his MIT experience. His wife, Kyoko, teaches English conversation, their son, Yohki, is in the fifth grade and likes to play baseball, and their daughter, Ai, is in the second grade. . . . **Roman M. Lubynsky**, SM '89, became vice-president for marketing and technology of Fasfax Corp. in Nashua, N.H., last September. He and his wife Karen Golz live in New Hampshire, but he comes down to Kendall Square "pretty regularly." . . . Since November 1989, **Oscar R. Marceillac Larrea**, SM '89, has been manager of the International Division of Richard O. Custer S.A. in Lima, Peru. . . . **Christa Mayerl**, SM '89, is a new product development associate with Lonza, Inc., of Fairlawn, N.J. . . . **Minoru Nomura**, SM '89, is manager of corporate technical administration of Dainippon Ink & Chemicals in Tokyo, Japan.

Meir H. Zucker, SM '89, has been working as account manager in sales at Teradyne in Waltham, Mass. He wishes everyone the best in the New Year.—Kathy Abourached, Management of Technology Program, MIT, E52-125, Cambridge, MA 02139.



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Leonard Berkowitz '58
James S. Bruce '39
Arnaud F. De Vitry D' Aveucourt '51
Cherry L. Emerson '41
John E. Fay II '71
Michael S. Gerstein '64
Donald G. Jordan '41
James Lago '47
Paul R. Larson '54
Walter F. Lenoir, Jr. '36
Frank M. Majewski '34
Edward A. Mason '50
Guy T. McBride, Jr. '48
John E. Millard '35
Edward W. Nicholson '36
George C. Putnam '36
Robert L. Richards, Jr. '51
Robert J. Richardson '54
Walter S. Smith '30
Herbert L. Stone '53
Robert S. Timmins '57
William E. Tucker, Jr. '42
Jon R. Valbert '64
Benjamin T. Woodruff '36

Chemistry

Elwood P. Blanchard, Jr. '59
Frank G. Chesley '40
Lionel S. Galstaun '34
Arthur S. Obermayer '56
Paula J. Olsiewski '79

Civil Engineering

John F. Kennedy '76
Shih Y. Lee '43
Thomas S. Maddock '51
James H. Maxymilian '61
Robert F. Weinberg '50
Kai-Kit Wong '61

**Earth, Atmospheric
& Planetary Sciences
(includes Meteorology)**

Paul L. Cloke '54
Leonard W. Weis '47

Economics

Robert W. Adams '51
Scott E. Pardee '62
Heather L. Ross '70
Balbir S. Sihag '78
Robert A. Taggart, Jr. '74

**Electrical Engineering
& Computer Science**

James S. Bell '33
Michael D. Gerstenberger '85
Robert F. Hossley '73
Robert M. Johnson '56
Alexander Kusko '44
Gordon M. Lee '44
Edward F. Magnusson '48
Isaac H. Mandil '41
James R. Melcher '62
Hyde M. Merrill '72
Louis L. Odette '81
Alexander L. Pugh III '53
Howard L. Yudkin '59

Graduate Management

Robert W. Adenbaum '50
Bruce B. Bates '54
William H. Bean '71
Gary E. Beck '74
James B. Brown '82
Scott E. Butler '81
Edmund D. Cianciarulo, Jr. '65
Peter F. DiGiammarino '77
Fred M. Fehsenfeld, Jr. '75
Russell M. Frankel '71
Thomas C. Gaputis '73
Edward M. Giles '59
John C. Grant '79
Donald M. Hague '77
Leslie C. Hruby '73
Clay Johnson III '70
Andrew D. Lawrence '85
Judith C. Lewent '72
Charles L. Meador '72
David C. O'Brien '53
Donald H. Peters '69
Barry M. Richmond '79
Susan K. Sudman '75

Kong-Heong Tan '71
Thomas G. Weld '88

**Materials Sciences &
Engineering**

Harvey K. Bowen '71
Min-Hsiung Tsai '72

Mathematics

John H. Doles III '69
Andrew M. Odlyzko '75
Janice R. Roszbach '51
Robert E. Sacks '75
Larkin R. Scott '73
Claude E. Shannon '40
Dale R. Worley '84

Mechanical Engineering

William M. Brobeck '33
Robert H. Davis '50
Eugene L. Foster '53
Herbert P. Haley '35
Lawrence H. Linden '76
Pangal N. Nayak '62
Raimund G. Vanderweil, Jr. '63

Nuclear Engineering

Dale E. Crane '67
John M. Neill '61

**Ocean Engineering (includes
Naval Construction)**

Dennett K. Els, USN '44

Physics

Solomon J. Buchsbaum '57
Frederick S. Holmes, Jr. '73
Jay T. Last '56

Political Science

Jesse L. White, Jr. '79
Thomas W. Wolf '81

Senior Executive Program

Roberto Giannini '81

Sloan Fellows Program

Charles R. Adler '60
Robert S. Ames '54
Daniel J. Carroll, Jr. '77
Mrs. Russell De Young '40
James B. Ellis II '80
Harold J. Fitzgeorge '64
David Friedman '87
Leonard W. Golden '55
Robert B. Horton '71
Michael A. Leonard '71
Katherine J. Magrath '76
Carroll M. Martenson '54
Richard J. Santagati '79
Alan Tawil-Kummerman '82
Thomas J. Vincent '68

Urban Studies & Planning

Adele F. Bacow '77
Gary A. Hack '76
Russell C. Lindner '86
Robert A. Melting '69
Ovadia R. Sinha '57
Edward C. Yang '85
Barry J. Young '68

Undesignated

Elizabeth J. Yeates '74

Honorary

Robert R. Shrock

Friends

Bennett H. Berman
Mr. & Mrs. Philip S. Chanen
Nancy Li
Alexander Weissburg



Great Dome Associates

1913

Charles L. Burdick
Walter P. Muther

1916

Alexander Brest
J. D. Robertson

1917

Cornelius C. Coakley
Leo I. Dana
Alfred J. Ferretti
George H. Stebbins

1918

Arthur S. Williams

1919

Francis A. Weiskittel

1920

Malcolm S. Burroughs
Henry P. Massey

1921

Edward R. Chilcott
Carole A. Clarke
Arnold R. Davis
Philip H. Hatch
Edward W. Haywood
Herbert A. Kaufmann
Myer H. Naigles
Edward P. Wyde

1922

Irving Abrams
Saul J. Copelman
Robert F. Cummings
David H. Harris
Edwin H. Koehler
Edward J. O'Connor
Walter M. Saunders, Jr.
Karl E. Schoenherr
James B. Spratley
Dwight VandeVate
Eugene V. Van Pelt, Jr.
Samuel I. Zack

1923

William P. Allis
Edward Battey
Horatio L. Bond
August A. Buhler
Charles T. Burke
Franklin G. Clement
Michael A. Drazen
Harry Green
William S. LaLonde, Jr.
J. H. Scholtz

1924

Everett C. Atwell
Walter J. Bagby
Roland N. Black
Homer S. Davis
George D. Fife
Leo Grossman
Allen W. Hawkins
Richard Lamborn
Gardner B. MacPherson
Anthony D. Matarese
Donald E. Moore
Victor C. Smith

1925

Gates W. Burrows
Alan W. Crowell
L. P. Elliott
Franklin L. Foster
Franklin Fricker

Maurice B. Frost
Henry B. Hibbard
Maxon H. King
Russell C. Mader
Russell G. Meyerand
Alexander J. Rokicki
Anthony G. Tsongas

1926

Robert W. Conly
William W. Farr
Alfred W. French, Jr.
John A. Gibson, Jr.
Thomas D. Green
Reverdy Johnson
Joseph L. Levis
Albert P. Libbey
Charles E. McCulloch
Charles P. McHugh
Charlotte T. Phillips
Louis R. Taylor
Joel S. Tompkins
George A. West

1927

Francis E. Anderson
Elwood A. Church
Harold J. Creedon
Lawrence W. Day
E. R. de Luccia
Walter F. Fathauer
Lawrence B. Grew
Gustavo Lobo, Jr.
Lloyd R. MacAdam
Charles W. Meytrott
Leroy G. Miller
Herbert Parkinson
Samuel Pearlman
Jack B. Peters
Louis B. Peterson
William H. Richards
Harland P. Sisk
Frank C. Staples
Ezra F. Stevens

1928

Charles S. Carter
Arthur R. Elliott
Newton S. Foster
Lawrence Glassman
Albert J. Gracia
William M. Hall
John J. Hartz
Edward H. Holmes
David Ingle, Jr.
Arthur C. Josephs
Ernest H. Knight
Gerard A. MacGillivray
Paul J. Martini
Walter F. Matlage
John T. Metcalf
James S. Morse
Noel C. Olmstead
Albert J. Puschin
John K. Rouleau
Abraham G. Stone
Thomas S. Wood, Jr.

1929

Earl H. Abbe
Eric A. Bianchi
Richard E. Bolton
Putnam Cilley
Arnold W. Conti
William E. Creedon
Paul F. Donahue
Hyman J. Fine
Vincent F. Gardner
Alfred H. Hayes
Donald S. Hersey
Malcolm M. Hubbard

The following alumni/ae and friends of the Institute contributed gifts of \$250-\$999 during Alumni Fund Year 1989 (July 1, 1988 through June 30, 1989) and are recognized as MIT Great Dome Associates. The names of alumni/ae who wish to be anonymous are not shown. Questions regarding Great Dome Associates should be directed to Joseph P. Recchio at (617) 253-8213.

William H. Lerner
Joaquin J. Llanos
Almer F. Moore
Austin S. Norcross
Ernest G. Peterson
William W. Saunders
Wade H. Shorter, Jr.
Amasa G. Smith
Louis F. Southerland, Jr.
Warren A. Spofford
Donald H. Valentine
Carlton E. Wood

1930

Lawrence B. Anderson
John F. Bennett
Benjamin C. Buerk
Elmer R. Burling
Biagio A. Carideo
Homer L. Davis, Jr.
Leonard H. Goodhue, Jr.
Maurice S. Herbert
Philetus H. Holt
Winwin M. Kingsley
Robert F. Lent
Arthur D. Roberts
Irvine E. Ross, Jr.
Anthony R. Savina
John J. Scheuren, Jr.
Parker H. Starratt
Lester Steffens
Ernest J. Tauch

1931

Herbert K. Allbright
Henry E. Baratta
Christian R. Binner
Charles Broder
William B. Cutter
John H. Dodge
Philip Donely
Edwin J. Ducayet
Frederick C. Eaton, Jr.
Clement H. Hamblet
William C. Kay
Albert L. Kaye
Addis E. Kocher
Donald S. Loomis
Francis A. Lutz
George Moy
William A. Pitbladdo
Henry D. Randall, Jr.
F. D. Schweitzer
Benjamin B. Shulkin
Albert R. Sims
H. S. Smith
William A. Stellrecht
John R. Swanton, Jr.
Charles W. Turner
Kenneth E. Wachmeyer

1932

William F. Bannon
Robert T. Billings
Edward F. Cahoon

Melvin Castleman
Sidney M. Edelstein
John W. Flatley
Joseph C. French
Joseph L. Friedman
William H. Heidtmann
George R. Klein
Eugene F. Lynch
Charles E. McCormack
Edmund F. McLaughlin
Jacob Millman
Robert K. Mueller
Samuel G. Nordlinger
William H. Reid
James G. Ritchey
James J. Robson
Thomas R. Smith
Charles H. Taylor

1933

Charles E. Cashman, Jr.
George R. Churchill
George L. Cory
Warren S. Daniels
Robert A. Dobson
Donald G. Fink
Guido M. Garbarino
Arthur S. Hayden
Robert Heggie
George E. Hughes
Paul J. Petitmermet
Frank A. Record
Stephen H. Rhodes
Richard Robinson
John R. Sloat
Adam J. Sysko
Warren G. Webster
Robert H. White

1934

Cassius C. Belden
Walter W. Bird
Alexander M. Blakely
John G. Borger
Leo A. Carten
Edgar B. Chiswell
Elizabeth S. Close
Roger T. Coffey
Robert R. Cull
Kenneth L. Dorman
Lawrence C. Ebel
Joseph Fishman
George L. Gahn, MD
George C. Hatch
Walton W. Hofmann
Robert M. Jordan
Henry N. Karr
Theodore O. Kresser
Emerson P. Kron
Irving R. Kusnitz
Douglas C. MacMillan
John J. McHugh
Jerry B. Minter II
Walter F. Read
Theodore N. Rimbsch

Robert K. Roulston
Herbert R. Schwarz
Frederick Spaney, Jr.
Theodore Steinberg
Bernard N. Stiller
Albert M. Talbot
Warren L. Towle
Philip B. Walker, Jr.
Max Winer
Walter L. Wise, Jr.

1935

John H. Anderson
Bruce R. Bagley
John G. Benson
Lester A. Brooks
James E. Castle
Jacob I. Castleman
Thonet C. Dauphine
Richard H. Eshbaugh
Gerhard T. Feyling
Ellis M. Fink
Robert F. Flood
Paul L. Gilmont
Frank R. Hatch
Richard L. Hughes
Franklin F. Lovering
George N. Lykos
Robert C. Madden
Rollin D. Morse
Bernard H. Nelson
Richard L. Shaw
Robert W. Spinney
Frank S. Walters
Chandler Wentworth
Kasmierz J. Winiarski

1936

Aldo H. Bagnulo
James G. Baker
Leonard B. Chandler
Edward E. Christopher
George F. Crummey
Kathleen V. Cummins
Vincent T. Estabrook
Lewis Gelbert
Martin A. Gilman
Eli A. Grossman
Anton E. Hittl
Aurelius P. Hornor, Jr.
Stanley T. Johnson
Walter K. MacAdam
August V. Mackro
Brockway McMillan
Harold F. Miller
John A. Myers
Roman L. Orlynsky
James F. Patterson
Lawrence G. Peterson
Frank L. Phillips
John C. Rowell
Dorian Shainin
George N. Tower, Jr.
Roman I. Ulans

1937

Roger C. Albiston
Frederick J. Altman
Charles M. Antoni
William O. Arnold
John C. Gibbs
Robert C. Glancy, Jr.
Archibald R. Graustein, Jr.
Daniel J. Hanlon, Jr.
Charles F. Healey
Francis X. Maids
Leon A. Mend
Gilbert C. Mott
John B. Nugent
Thomas A. O'Brien
Philip H. Peters

Melvin A. Prohl
Harold E. Prouty
John C. Robbins, Jr.
Norman B. Robbins
Joseph A. Smedlie
Robert H. Thorson
Edward F. Tibbetts
Ralph P. Webster, Jr.
Albert E. Whitcomb
Duane O. Wood
G. R. Young

1938

Lewis H. Allen, Jr.
Franklin S. Anwater
Howard Benzett
Donald R. Barneby
David W. Benman, Jr.
John S. Bethel, Jr.
Joseph G. Bryan
Harold W. Butler
Jeanne V. Buxbaum
Abbott Byfield
Dempster Christenson
Albert M. Clogsten
Russell C. Coile
Robert S. Gordon
Gifford Griffin
Horace H. Homer
Roy C. Hoggood
Harold James
Sumner H. Kalin
Solomon Kaufman
Frank B. Kemp
John C. Kinnear, Jr.
H. B. Leslie
Ira H. Lehman, Jr.
Donald S. MacDonald
Anne S. Mowat
Enver Muradoglu
John A. Petroskas
James P. Pollock
William F. Purcell
Clark S. Robinson
Ascher H. Shapiro
Cornelius J. Starr
Harold H. Strauss
Edward K. True
Vernon C. Winn

1939

John F. Allen
George W. Beer
George W. Cannon, Jr.
Louis S. Castleman
Roland W. Caywood
F. S. Chapin, Jr.
Harold Chestnut
John H. Crankshaw
George D. Cremer
Camillo P. Epifano
David S. Frankel
Gus M. Griffin
Richard H. Guthrie
William E. Haible
Richard Hanau
Herman H. Hanson
Roy C. Heacock
Ralph L. Hegner
Clinton R. Hilliker
Charles F. Hobson, Jr.
John N. Hobstetter
Ernest R. Kaswell
David G. Kaufman
Burkhardt A. Kleinhofer
Benjamin L. Krause
Julius A. Lucas
Lawrence M. Lyons
Charles A. MacArthur
Joseph A. Neuendorffer
Humbert P. Pacini

Joseph E. Parry, Jr.
William H. Phillips
Harold W. Pope
George G. Poulson
Robert W. Pratt
Earl N. Reynolds
Burton D. Rudnick
Charles T. Ryder
Robert B. Sackheim
Paul E. Sandorff
Alan P. Schreiber
Carl A. Segerstrom, Jr.
Harold F. Snow
Rodolfo M. Soria
Alexander Squire
Robert V. Sternberg
Oswald Stewart
Robert A. Stone
Douglas J. Taylor
Alexander M. Thackara
Wallace P. Warner
Theodore A. Walton
Frances G. Wyler
Joseph G. Zeitlen

1940

Martin A. Abkowitz
Edgar W. Adams, Jr.
Otto F. Arnold
James L. Baird
Scott Brodie
Harvey H. Brown
Roy W. Brown
Knight S. Carson
M. A. Copeland
Margaret T. Dienes
Norman B. Duffett
Richard J. Eberle
James E. Fifield
Morris I. Gabel
Richard E. Gladstone
David R. Goodman
Robert V. Gould
Harold Graham
William H. Hagenbuch
Donald R. Harper
Edward G. Heller
Winfield H. James
Amos E. Joel, Jr.
Lawrence G. Jones
John L. Joseph
John Kapinos
Joseph K. Knight
Frederick Lange
John G. Leschen
Joseph F. Libsch
David F. Lowry
Marshall D. McCuen
Richard F. McKay
Robert G. Miller
Ralph T. Millet
Judson C. Rhode
Stanley C. Snowdon
Philip A. Stoddard
Ralph N. Thompson
Melville S. Toon
John A. Vanderpoel
Laur Don Wheaton
George M. Wolfe

1941

Zachary P. Abuza
Johan M. Andersen
Stanley Backer
Robert E. Bailey
Albert L. Bensusan
Robert W. Blake, Jr.
Robert W. Blake
Roger G. Blum
George B. Boettner
William T. Butt
Ralph B. De Lano, Jr.
Robert J. Demartini
Martin L. Ernst
William M. Folberth, Jr.
Lewis D. Fyke
Franklin Hawkins
Rudolph W. Hensel
Lewis T. Jester, Jr.
William E. Lamar
Richard A. Lazarus
William E. Lifson
Robert S. Lundberg

Eugene A. March
Mitchell J. Marcus
Newell H. McCuen
Milton R. McGuire
Vaughan Morrill, Jr.
Joseph S. Quill
Harold Radcliffe
Kenneth A. Roe
John F. Sexton
Robert E. Smith
John J. Symons
Payson S. Tsau
Rodrigo Uribe

1942

Arthur W. Aven
Lawrence E. Beckley
William A. Bolhofer
Charles E. Bossi
David Christison
Robert H. Crosby, Jr.
Luther Davis, Jr.
Howard T. Evans, Jr.
Philip E. Fox
Richard X. Gannon
Robert H. Given
Charles S. Hofmann
Alphonse P. Hotte
Alan W. Katzenstein
Warren S. Loud
Alan B. Macnee
Charles D. Magdick
Adrian G. Marcuse
Claude M. McCord, Jr.
Carl L. McGinnis
Joseph R. McHugh
David B. Robinson
Milton M. Platt
William A. Rote
Robert N. Secord
Morris A. Steinberg
Edward P. Todd
Peter G. Volanakis
Carl Zeitz

1943

George W. Bartlett
Frank E. Briber, Jr.
Bernard Brindis
Charles F. Chubb, Jr.
Charles A. Duboc
Thomas K. Dyer
David M. Falk
George Feick
Ralph R. Feuring
John M. Fiore
William G. Franklin
Ward J. Haas
Stewart M. Hill
James F. Hoey, Jr.
Richard F. Jouanet
Cyrus H. Kano
William R. Kittredge
Charles J. Lawson, Jr.
Israel Z. Lenzner
Hung Liang
John G. Linnell
Thomas K. Maples
James D. McDonough
John M. Miller
Thomas A. Mitchell, Jr.
Robert L. Rorschach
Don H. Ross
William A. Selke
John M. Sewell
Frederick C. Smith
John C. Stetson
Donald R. Stevens, Jr.
Edmund R. Swanberg
Herbert G. Twaddle
William A. Verrochi
Hans G. Walz
Thomas W. Winstead
Michael Witunski

1944

Mario D. Banus
Ralph A. Barrows
Norman Beecher
Robert E. Benedict
Richard S. Bettles, Jr.
Warren A. Bishop
Henry N. Bowes

John H. Burdakin
Robert M. Byrne
Herbert L. Carpenter, Jr.
John Chamberlain
Andrew Chaplin
Frank K. Chin
Robert M. Copsey
Edward H. Cumpston
Louis R. Demarkles
Laurence E. Dowd
Russell D. Dragsdorf
Bernard J. Duffy, Jr.
Lee C. Eagleton
Roger M. Freeman, Jr.
Weston W. Goodnow
Holton E. Harris
Harold B. Higgins
Richard H. Hinchcliff
Robert V. Horrigan
Warren H. Howard
Austin T. Hunt, Jr.
William A. Jack
Walter A. Jaeger
John H. Kellogg
Martin King
Herbert F. Knappe
Gilbert K. Krulac
Lorenzo A. Lamadrill
Han T. Liu
Henry A. Lurie
Albert Madwed
John W. Matthews
Kenneth W. Nelson
Robert Oppenlander
Clifford S. Powell
William S. Richardson
Paul M. Robinson, Jr.
George S. Saulnier
Andrew J. Schmitz, Jr.
Norman I. Sebell
Leland F. Stanley
Hugh M. Taft
Robert V. Thiede
Page S. Ufford, Jr.
John Upton, Jr.
Chester L. Woodworth
John Woolston, USN
William A. Wynot

1945

James M. Barrabee
Walter E. Borden III
David P. Flood
Charles H. Hart III
Sing Leong
Andrew A. Marocchi
William G. Martin, Jr.
Thomas J. McNamara
William J. Meade, Jr.
Warren H. Miller
Nicholas V. Mumford, Jr.
William H. Pastfield
Philip J. Pocock
David O. Richards
Eugene S. Rubin
Max E. Ruehrmund, Jr.
Luigi J. Russo
Robert K. Schumacher
Clinton H. Springer
Edward Stoltz, Jr.
Harold Thorkilsen

1946

Richard M. Adler
Lylal D. Asay
Louis B. Barber
Edward L. Belcher
Raymond E. Benenson
Lawrence G. Body
Sterling S. Bushnell
Charles E. Cloud
Daniel I. Cooper
James S. Craig
Hillman Dickinson (Ret)
Thomas J. Donnelly
Stanley T. Droski
John S. Filbert, Jr.
James A. Finney, Jr.
Alexander E. Halberstadt, Jr.
Sigurdur G. Halldorsson
Robert F. Hoffman
Ernest G. Jaworski
August R. Krenkel

Mason I. Lappin
Gilbert Marr
Alexander W. McEwan
John M. McMillin, Jr.
James S. Murphy
Barbara R. Murray
Charles E. Peck
James C. Ray
Donald E. Robison
Arthur Schiff
Richard J. Steele
John F. Sullivan
Warren H. Turner
John L. Wandriscio

1947

Robert F. Athow, USN
John E. Bartelt
Thomas H. Bay
Samuel L. Bernheim
Peter Callejas
Daniel J. Carnese
William J. Crawford III
Robert N. Craek
John M. DeBell, Jr.
Steffen F. Diekmann
Walter R. Ericsson
Carl E. Eyman, Jr.
Rufus M. Franklin
David H. Frantz, Jr.
Wilfred L. Freyberger
Virginia I. Grammer
James E. Haggett
Theodore B. Hogg, Jr.
John G. Holmes
Charles W. Hoover, Jr.
Arnold S. Judson
Kenneth A. Marshall
John C. Martin
John E. Maxfield
William R. Melville, Jr.
James G. Moir, Jr.
John J. Murphy
Aaron Newman
Gilbert S. Parker
Alexis Pastuhov
James L. Phillips
Joseph J. Riley
Richard A. Scheuing
Paul K. Schilling
Martin D. Schwartz
Irving L. Schwarz
Harry Sherman, Jr.
William R. Smith-Vaniz
Bruce W. Stockbridge
Marvin W. Sweeney, Jr.
Ferdinand S. Voith
William H. Wiehl
Howard A. Zwemer

1948

Stanley Abkowitz
Eugene Ashley
Fred C. Bailey
Marshall E. Baker
Benjamin C. Ball, Jr.
William Bangser, Jr.
John A. Baring
Richard V. Baum
Edwin S. Bell
Richard C. Berry
William H. Bertollet III
S. M. Billett
Carl Blake
Barry M. Bloom
Joseph J. Bongiovanni
George H. Browne, Jr.
Thomas J. Cahill
Albert F. Carr
Cassius M. Clay
George F. Clifford
Richard J. Conlan, Jr.
Bernard P. Davins
George S. Dundon
Guido J. Frassinelli
John L. French
Robert S. Friedman
Edward S. Frohling
Alden F. Greenlaw
Peter A. Guercio
Robert W. Hanpeter
Geraldine M. Haughey
John W. Hawkins
Edwin E. Hebb, Jr.

Robert O. Hirsch
William N. Hosley
Donald Jenkins, Jr.
Robert H. Jenkins
William J. Joyce
William E. Katz
Benjamin F. Kendig
George P. Loomis
Louis F. Kreek, Jr.
Herbert Kurinsky
Philip M. Lally
Irwin L. Lebow
James Leon
Charles W. Loufek, Jr.
Franklin E. Mange
Boni P. Martinez
Manuel L. Matnick
John C. Moore
Robert R. Mott
John E. Nicholson
Julian F. Pathe
Donald M. Perkins
Gordon H. Pettengill
Thomas H. Pigford
William R. Porter
Louis C. Rasmussen
Frederic M. Richards
Gilbert V. Rohleder
Joel N. Rossen
Jay S. Salt
Robert L. Sandman
William B. Schmidt
George E. Sherman
Arnold M. Singer
Arnold H. Smith
James T. Smith
Earl K. Solenberger
Leonard J. Stutman
Julian D. Taub
Donato R. Telesca
John M. Welch
Henry Warner
Robert R. Wilke
Harvey B. Willard
Backman Wong
Haig S. Yardumian
Norman S. Zimbel

1949

Ira R. Abbott, Jr.
Hermann A. Allen
Frank M. Anthony
Antonio A. Armentante
Robert A. Arison, Jr.
John W. Barriger IV
Orlien N. Becker
Paul S. Berrow
Robert D. Bigelow
Walter P. Bloescher, Jr.
Barton Brown
Bruce Campbell
Elda Chisholm
Norman A. Chrisman, Jr.
Gunnar F. Christensen
Leslie W. Cline, Jr.
Gary S. Colton
Richard A. Cousins
Stanley S. Davies
William S. Edgerly
John Fairfield, Jr.
Guilford W. Forbes
William A. Forsyth, Jr.
Samuel A. Francis
John W. Goppelt
Alfred N. Gordon
Daniel W. Greenbaum
Ronald L. Greene
Robert W. Grott
Oliver S. Hegerman, Jr.
Robert L. Hamman
Frank B. Harris, Jr.
Howard E. Hendershott, Jr.
Dwight H. Hibbard
Charles K. Holmes, Jr.
Charles W. Holzworth
Arthur M. Howarth
Sidney C. Howell
Robert E. Hughes
David B. Kellom
Edward M. Kerwin, Jr.
John A. Knowlton, Jr.
Malcolm H. Kurth
Thomas J. Lamphier

Frank G. Lane
Richard E. Lang
Ray E. Larson
Ingram Lee II
Albert A. Livingston
Demetre P. Ligor
Raymond A. Lindstedt
George P. Loomis
Arthur C. Loven
William J. Lueckel, Jr.
John T. Lumis
Harvey E. Lyon, USN
Stanley V. Margolin
Richard H. Marlowe
Robert L. McConaughy
Gregor F. Meyer
Richard D. Morel
Mariano Ospina Hernandez
Paul B. Ostergaard
Chester M. Patterson, Jr.
Jan B. Peyrot
Howard A. Reuter
Lewis H. Roosa
John R. Saxe
William C. Schneider
Gordon D. Shingleton
Nathan Q. Sokal
Herbert L. Spivack
Bernard D. Steinberg
Norman Stolz
Edward T. Thompson
John T. Toohy
Charles M. Walker
Eugene E. Woodward
Ernesto H. Zapata
Marvin D. Zimmerman

1950

David D. Adams
Walter S. Attridge, Jr.
George A. Basta, Jr.
Norton Balknap
Howard P. Bill
Beymon Blanchard
Ralph W. Booker
Donald R. Bresky
Sterling G. Brisbin
Richard C. Brogle
Thomas C. Buchanan
William L. Carey
Cosimo L. Cataldi
Robert A. Cesari
Warren F. Clement
John W. Craig, Jr.
Allyn W. Eade
Armen J. Esserian
James M. Fitzpatrick, Jr.
Harry G. Foden
Melvin J. Gardner
James W. Geiser
Sebastian J. Gianni
Thomas N. Goffrey
Robert E. Gordon
Frederic D. Grant
Malcolm Green
Robert A. Haass
Donald A. Harnsberger
Herbert L. Hochberg
Francis X. Hogan
James A. Hooper
W. J. Kocher, Jr.
John S. Lane
John B. Lawson
Gerald A. Lessells
Stanley Martin, Jr.
John T. McKenna, Jr.
Jones Medney
Edwin B. Miller
J. M. Mitchell, Jr.
Raymond M. Moeller
William E. Moos
William Murphy, Jr.
Will F. Nicholson, Jr.
Charles D. Nolan
Paul F. Pearce
Philip K. Pearson, Jr.
Alfred M. Petrofsky
Robert L. Plouffe, Jr.
Richard R. Potts
Albert Rand
Milton L. Rand
Herbert A. Ridgway
Henry C. Sharp, Jr.

Thomas E. Shepherd, Jr.
Vinson R. Simpson
Henry H. Skillman, Esq.
Edward R. Stover
Wendell G. Sykes
Dan R. Test
Constantine T. Tsitera
James R. Turner
Anthony Vinciguerra
Paul B. West
Robert E. Wilson
Robert W. Wright

1951

Marshall E. Alper
Raymond D. Atchley
Manfred E. Becker
John H. Bergmann
Christian C. Bolta
Edward L. Bronstien, Jr.
William J. Cavanaugh
John C. Conzett
John F. Dennis
William H. Dodrill
George L. Downie
Jerome I. Elkind
Charles W. Ellis III
Allan Elston
Frederick D. Ezekiel
Richard L. Foster
Madge Goldman
Richard T. Greenhill
David A. Grossman
Thomas G. Hagan
Avrom R. Handlerman
Parker W. Hirtle
Lawrence W. Hitchens
Albert E. Hughes
Windsor H. Hunter
Rodney G. Huppi
Joseph Iannicelli
Henry R. Jex
Hubert E. Knipmeyer
J. F. Koehler
Lawrence K. Koehler
Robert W. Kress
Frederick G. Lehmann
Robert A. Lindquist
Robert L. Lord
Gerald E. Lyons
Henry N. Marsh, Jr.
James K. McCauley
William R. Miller
Anthony E. Miri
George H. Myers
Alfred P. Olivera
Arthur Orenberg
Charles A. Orne, Jr.
John F. Pasieka
William D. Pinkham, Jr.
James A. Pitcock
Lester W. Preston, Jr.
John S. Prigge, Jr.
Frederick A. Radcliffe
William G. Rhoads
Jay Rosenfield
Samuel Rubinovitz
George E. Schultz
Joseph N. Sherrill, Jr.
Harold A. Siegel
Howard E. Simmons, Jr.
Lester M. Stocum, Jr.
Paul G. Smith
David M. Sparing
Anthony Stathopoulos
Richard Strauss
Herbert B. Voelcker
John J. Welch, Jr.
Bernard Widrow
Herbert H. Woodson
I. V. Yancey

Milton S. Dietz
James Dorsey
Bradford W. Edgerton
Daniel E. Fingers
Alan S. Geisler
Herbert Glantz
Jackie H. Guthrie
Nicholas J. Haritatos
Richard E. Heitman
Clifford H. Heseltan
Richard F. Jenney
Paul R. Johannessen
Sanford A. Kaplan
James K. Knowles
Harry S. Kradjan
Raymond D. Kramer
Richard F. Lacey
William H. Lane
Jack Larks
Michael D. Lubin
Daniel H. Lufkin
Paul A. Lux
Richard E. Lyle
Alex S. Malaspina
Edward K. Matthews
Kevork V. Nahabedian
Robert H. Norton
Ralph E. Raynard, Jr.
John B. Savoca
Clifford M. Sayre, Jr.
Bradford H. Schofield
Erwin E. Schowengerdt, Jr.
Stanley J. Solomon
H. S. Spack
James I. Stockwell
James S. Stolley
James R. Strawn
Stanley H. Sydney
Donald F. Tarinelli
Emil J. Volcheck, Jr.
Seymour S. Weintraub
Andreas Wessel
Frank T. Wheby

1953

Ralph Anglin
David M. Berg
E. F. Brecher
John R. Ehrenfeld
Norman C. Ford, Jr.
Morton J. Friedenthal
Gilbert D. Gardner
Kent F. Hansen
George B. Hegeman
John F. Horning
Lionel L. Kinney
David L. Klepper
Richard I. Linde
Richard S. Lindstrom
George T. Marcou
Douglas L. Meyer
Joan M. Mizer
John C. Morgenstern
William S. Nagel
Lawrence N. Odence
Herbert M. Oestreich
Robert R. Piper
Burton M. Rothleder
Stanley J. Sadowski
Paul P. Shepherd
Willard B. Spring
Maurice L. Torti, Jr.
G. H. Tseklenis
Tollyn J. Twitchell
Jon Van Winkle
James A. Zurbrigen

1954

Gordon Aitken
Robert E. Anslow
Bernarda B. Black
John Blair
Wallace P. Boquist
Michael B. Boylan
James W. Brown, Jr.
Raymond E. Cairns, Jr.
Jerome Catz
Phil Chandler, Jr.
John S. Clauss, Jr.
Donald M. Dix
William J. Eccles
Wilbur P. Fiske
Philip Gilbert

Donald T. Goldberg
John H. Gusmer
Arthur W. Haines
William L. Hartrick
Ernest C. Hinck III
Dean L. Jacoby
James E. Klapmeier
Stephen J. Lirot
Samuel J. Losh
Louis E. Mahoney III
Kenneth S. Marks
Robert P. Mason
Richard G. McKee
Raymond D. Mintz
Luis E. Perez Olivares
George L. Perry
John M. Peterson
Robert W. Reichard
Frederick Rubel, Jr.
Francis J. Ryan
William H. Ryer
Philip R. Sayre
Marilyn L. Shilkoff
Charles M. Smith
David F. Springsteen
Robert W. Stewart, Jr.
James R. Stuart
Robert J. Sukenik
George M. Thurlow
Jerome D. Wayne
Klaus M. Zwinsky

1955

Paul H. Attridge
Richard I. Bergman
Robert F. Buntschuh
Edwin A. Chandross
Zaven A. Dadekian
Alan S. Dana, Jr.
Gilbert Davidson
Joyce P. Davis
William T. Deibel
Robert G. Dettmer
Robert G. Dunn
James H. Eacker
Philip N. Eisner
Eduardo L. Elizondo
Charles A. Gordon
Robert P. Greene
Michael E. Halpern
John F. Hayes
John T. Kennaday
Warren H. Lattot
Gordon R. Lohman
Stephen B. Loring
Roger D. Mackay
Gerald P. Maloney
Wayne C. McClung
Paul F. Mosher
Richard D. Nordlot
Sidney J. Parry
Frank E. Perkins
Charles T. Prewitt
Charles S. Robertson, Jr.
Gregory L. Robillard
Randall S. Robinson
Walter Rubin
Walter G. Shifrin
John R. Stopfel
Allen G. Terbox, Jr.
R. P. Toahy
Victor M. Tyler II
Philip A. Untersee
John F. Wing

1956

Mohammad M. Akhavan
Victor J. Bauer
Howard S. Bertan
Bernardo W. Blaschitz
Bruce B. Bradehoff
Arnold P. Breeden
Paul E. Brown
John A. Buell, Jr.
Richard N. Carlson
Paul S. Cianci
Ronald C. Clark
Stephen N. Cohen
William R. Dickson
Irwin Dorros
Walter J. Farrell, Jr.
Stuart Frank
Samuel S. Friedman

Larry R. Goldberg
Joel A. Hamilton
Kenneth E. Hickman
Robert J. Hochman
Charles P. Hoult
Evan T. Jones
Gordon Kane
David L. Kaufman
Robert L. Kissner
Paul H. Luckett III
Ronald J. Massa
Eugene Merfeld
John H. Merkl
Edward K. Moll
Joseph P. Neville
Richard E. Norwood
Anthony Praznik
David G. Quigley, MD
Bernard W. Romberg
Axel E. Rosenblad
Robert F. Santos
Robert N. Sawyer, MD
Gottfried T. Schappert
Lester J. Senechal, Jr.
Richard E. Skavdahl
Walter R. Sooy
John D. Stelling
James D. Stenborg
Paul H. Walter
Joseph L. Wauters, Jr.
Stanley T. Wray, Jr.
Thomas Yonker

1957

Paul G. Adler
Paul R. Ammann
Richard L. Baird
Arthur E. Bergles
Bruce Blanchard
Richard W. Bohlen
George H. Bormann, Jr.
Richard D. Brandes
David W. Chonette
John T. Christian
Howard I. Cohen
Bernard R. Cooper
William H. Doughty
Ronald E. Enstrom
Edward A. Friedman
Martin L. Gerson
Samuel J. Gerstenfeld
Boyd E. Givan
Arthur D. Hause
Robert P. Holton
Frederick L. Jaggi
Malcolm M. Jones
Robert M. Kline
Robert A. Kruger
Graham Lusk
Donald C. MacLellan
Uzal H. Martz, Jr.
Richard M. McCabe
Terrence K. McMahon
Frank E. Murphy, Jr.
Ross W. Newsome, Jr.
Donald A. Norman
Eliot J. Pearlman
John P. Penhune
Silvester Pomponi
Ralph C. Reynolds
Robert H. Rosenbaum
Jared J. Salfirstein
Henry E. Salzhauser
Herbert F. Schwartz, Esq.
Ira Skalet
Richard D. Smallwood
Richard Stern
Robert M. Sterrett II
Erwin H. Straehley
Lavette C. Teague
Francisco R. Villanueva
William R. Walsh
Robert C. West
Richard V. Westerhoff
Thomas L. Whitehouse
Benjamin J. Woznick, Jr.

1958

Arnold E. Amstutz
Hillel J. Auerbach
Roger D. Beggenstoss
Edwin C. Bell
David A. Berg

Coleman Bess
Frank J. Bielsik
Michael E. Brose
Joseph T. Burval
Stephen Corman
Dale N. Dukes
John F. Fallon
Irwin H. Fine
Richard A. Finn
Fred Fisher
John B. Forrest, Jr.
Willard E. Fraize
Stephanos S. Hadjiyannis
William R. Hauke, Jr.
Daniel J. Holland
Richard H. Hough
Dana Huestis
John C. Ingraham
Alan T. Johnson
Robert D. Jones
Kenneth H. Langley
Paul Z. Larson
King M. Lee
Hugh J. Murphy
Martin J. O'Donnell
Robert E. Oleksiak
Frederick W. Ostermayer, Jr.
Allen R. Philippe
Theodore M. Quist
David J. Rachofsky
Robert M. Rose
Paul H. Rothschild
George A. Russell
Howard C. Salwen
John M. Seavey
Louis B. Seigle
Matthew F. Smith
Steven R. Tannenbaum
James E. Tillman
Edward Wanger
Howard G. Ziff
Bazil R. Zingali

1959

Emile A. Battat
John H. Beynon
James M. Bowers
Gary L. Bracken
John W. Brackett
John I. Brauman
Lawrence J. Broutman
James H. Brown
Edward W. Cheatham
Gilbert Y. Chin
Louis Cohen
James B. Conklin, Jr.
H. R. Coward
Dwight B. Crane
David L. Dahmen
Paul H. Ekberg
George J. Elbaum
Jack M. Fischer
G. N. Harper
Owen G. Heseltan
R. M. Hendricks
George R. Huguenin
Michael D. Intriligator
Frank S. Koppelman
Myer P. Kutz
Wilbur S. Latimer
Stanley L. Levine
Bernard S. Levy
Albert H. Libbey
William R. Malone
William M. Marcus
John K. Mitchell
James P. Moran
Oscar L. Morgenstern
Donald E. Murray
Robin R. Oder
David F. Pawliger, MD
Leander F. Pease III
Adul Pinsuana
Carl H. Poedike, Jr.
James E. Rogers
Robert L. Rosenfield
Oliver E. Seikel, Esq.
Louis P. Sileo
Stephen Spooner
Nam P. Suh
J. R. Swenson
Lynn R. Sykes

Frank M. Trantanello
Daniel I. Wang
Jonathan B. Weisbuch
Stephen K. Whitemore
Marie M. Wray
Martin E. Zimmerman

1960

Ronald B. Agronin
Jon A. Aldrich
Phillip B. Allen
Paul F. Berg
Peter B. Brandt
Edward A. Bulenowski
Ronald M. Burde, MD
Edmond P. Coady
Abe Feinberg
Charles J. Garbarini
David H. Geisler
Garry L. Gibson
Joseph I. Goldstein
Standley H. Goodwin
Kenneth E. Hagen
Stephen E. Halprin
Charles H. Haspel
Gerald J. Hornik
Gerald H. Kaiz
Ivan M. Kasser
Deena A. Koniver
Morris J. Kriger
Andrew Larsen, Jr.
Robert E. Lienhard
Larry R. Martin
Edward D. McCartney
Richard L. McDowell
Kenneth T. McKie
Harry C. Nottelbart, Jr.
Richard H. Oeler
Harold J. Parmelee
Edward R. Pollard, Jr.
William M. Robertson
Howard L. Rosenthal
Mary E. Schumacker
William C. Shih
S. C. Simonson III
Anton K. Simson
Robert H. Smallman
Christopher R. Sprague
Linda H. Sprague
Robert S. Troth
Victor A. Utgoff
Leonard B. Vaughn
Daniel E. Whitney
Raymond G. Wilkins
Harold M. Woolf

1961

Peter R. Bankson
John S. Benjamin
John H. Bousman
Andrew G. Braun
Mitchell B. Brodskin
Alan H. Cohen
Richard D. Cummings
Ervin S. Davis
Joseph T. Davis
John M. Deutsch
Robert J. Dulsky
Dorsey C. Dunn
Donald D. Easson
Reed H. Freeman
Thomas L. Geers
George W. Gladfelter
Edward J. Grabowski
Peter R. Gray
William C. Grimmell
Arturo J. Gutierrez
Ted J. Hammack
Grady W. Harris
Thomas N. Hastings
Lawrence A. Horowitz
Robert S. Kaplan
Jerome M. Kaufman
Daniel W. Kennedy
John N. Kogan
John G. Layter
Joseph A. Lestyk
Richard F. McRay
Richard A. Meizer
Thomas P. Nosek
Richard F. Otte
Leslie C. Patron
Pedro J. Piedrahita

Gerald E. Pollon
David A. Roberts
Philip J. Robinson
Charles L. Ruttenberg
John C. Shambaugh
Mannie Smith
Nelson E. Stefany
Donald C. Straffin
Robert B. Teller
Peter Var Planck
Luis F. Villalobos
John A. Vitek
Samuel J. Williamson
Iver B. Ylvisaker

1962

Robert E. Anderson
Lloyd Armstrong, Jr.
Alfred H. Bellows
William D. Bloebaum, Jr.
Robert T. Brady
William T. Bray
Richard A. Bronson
Peter Brown
Michael J. Callahan
Vito A. Caravito
Alan L. Citron
Wallace E. Couch
Philip D. Cunningham
Neil Doppel
George S. Dotson
James R. Dressler
Edward A. Feustel
William J. Fry
Jeremy R. Goldberg
Theodore C. Goldsmith
Gerald L. Gottlieb
Sherwin Greenblatt
Ben B. Gunter, Jr.
Purik B. Halaby
Dennis R. Hafemann
Richard L. Hottor
Sang-Hak Hwang
Dwight A. Kellogg
Robert G. Kurkjian
Modesto A. Maidique
James D. Miller
Kehachiro Moriyasu
Robert A. Morris
Robert F. Morse
Stephen C. Root
Dorold W. Rorabacher
Allen H. Saye
Peter R. Shrier
Stephen R. Smith
Steven J. Smith
David S. Stare
Harold D. Stein
Gary M. Stuart
Roger J. Sullivan
Richard N. Sutton, MD
William M. Taylor
Michael R. Terry
Daniel E. Thornhill
Ronald R. Troutman
Melvin B. Weiss

1963

Paul D. Abramson, Jr.
Bruce Anderson
Thomas R. Anderson
Walter H. Berninger
Steven L. Bernstein
Michael C. Bertin
Henry W. Bowman
Dean W. Boyd
Stephen B. Bram
Frederick E. Cunningham
Laurence E. Demick
Steven R. Dittmeyer
C. L. Ehn
Bruce A. Eisenstein
James E. Evans
John K. Flicker
Frank Y. Fradin
Anthony W. Geisler
Russell J. Gershman
Keith D. Gilbert
Thomas A. Goddard
James M. Harris
Marley A. Herrin
Richard P. Hervey
James W. Holcroft
William A. Jessiman
Lawrence M. Kazanowski

Kenneth M. Klein
Surawut Kongsiri
Robert M. Levin
Alan T. Marty
Robert H. Maskrey
Robert M. Mason
Thomas A. Massaro
Ronald W. Matlin
Dale E. Miller
Peter M. Mlynarik
Frank S. Model
Robert H. Morse
Ruth R. Nelson
James W. Nick
Russell E. Prins
Alan Q. Ramo
Daniel R. Ross
Kenan E. Sahin
Michael J. Schaffer
Joel E. Schindall
Charles C. Schumacher
Patricia A. Sherman
Bernard Slosberg
Raphael Soffer
Gene D. Sprouse
James Y. Tang
Louis S. Thompson
Robert E. Turz
Roger N. Wallace
Ronald A. Walter
Robert A. Warman
Anthony M. Weikel
Richard N. Weiner
Walter B. Weiner
Cynthia K. Whitney
William J. Wolf, Jr.
Boh K. Yap

1964

John C. Adamchak
Walter M. Anderson, Jr.
Fredric M. Armstrong
Edward L. Arnn, Jr.
Robert Z. Bachrach
Ralph R. Bestock
Leslie M. Boring, Jr.
Gary R. Brooks
Truman R. Brown
Thomas B. Cheek
Paul Clermont
Ernest M. Cohen
Bruce E. Crocker
Steven R. Croppnick
Theodore J. Cruise
Franklin P. Darmory
Atif S. Debs
John P. Downie
Thomas W. Eggers
Kenneth E. Ekstrand
John G. Endriz
Robert L. Fischer
Richard S. Fisher
Michael B. Godfrey
Conrad E. Grundlehner
John N. Hanson
Anthony J. Heatwole
Jeffrey D. Heller
Robert H. Hobbs
Joseph V. Holweg
Robert S. Hopkins, Jr.
Roger L. Hybels
Steven N. Iverson
Mark Joseph
Joseph F. Kasper, Jr.
Philip S. Kilpatrick II
Lowell E. Kopp
Roger K. Lewis
Carl L. Mampay
William B. McClure
Paul G. McMullin
Seraphin S. Menendez
Donald J. Mided
Stephen B. Miller
Michael J. Monsler
Lita M. Nelsen
William A. Nelson, Jr.
Herbert O. Norton
William F. O'Halloran, Jr.
Mark R. Ordover
David R. Patterson
Robert P. Popadic
Richard D. Posner
John M. Rainier
Robert L. Rothman
David B. Russell, Jr.

David N. Saul
William A. Schefner
George T. Schmidt
James R. Schomer
Gary M. Selgson
Donald M. Stewart
David E. Sullivan
Jay M. Tenenbaum
Viguen R. Ter-Minassian
Francis D. Tuggle
John C. Uhrmacher
Douglas L. Veenstra
William L. Wallace
John W. Weber
Henry B. Weil
Robert A. Weinberg
Jerome I. Weiner
Bernard Yaged, Jr.

1965

Arnold R. Abrams
James J. Bochnowski
Peter F. Brown
Edward A. Bucher
Arthur A. Bushkin
William D. Carrier III
Ralph J. Cicerone
Calvin E. Cordulack
Charles W. Deane IV
John S. Duerr
Lane S. Duncan
Michael Edesess
James L. Elliot
Howard M. Ellis
Sidney J. Everett
Jeffrey L. Forman
William T. Freed
Peter G. Gerstberger
Robert P. Goldberg
John J. Golden, Jr.
Robert B. Grady
Scott D. Graham
Joel C. Greenwald
George L. Hadley
Thomas F. Hallam
Roger M. Harvey
Howard L. Helman
Edward P. Hoffer
Michael D. Huke
John G. Kassakian
William N. Kavesh
David M. Kettner
Lionel C. Kimerling
Thomas R. King
Louis A. Kleiman
Peter R. Kornafel
Jesse B. Lipcon
Richard H. Long
George C. McCurry
George W. McKinney III
Walter L. Miller
Robert B. Morgan
Herbert W. Mower
Edwin C. Moxon
Kayson Nyi
Calvin F. Opitz
James M. Piepmeier
John D. Roach
Kenneth Ross
Sharon Ross
Emile Sabga
Wyckham D. Seelig
Peter Sexton
Yazan N. Sharif
Donald L. Shulman
Richard S. Shultz, Jr.
Robert L. Silverstein
Douglas C. Spreng
Alan R. Stottlemeyer
Philip E. Strause
Richard W. Sullivan
Bruce D. Sunstein
Robert L. Waymost
Frank J. Weigert
Michael G. Weiss
Barry D. Wessler
Joel Westerman
Jerrod W. Wilcox
Ronald Wilensky
Stephen L. Williams
David L. Yuille, MD
Bruce C. Zotter

1966

James H. Batchelder IV

Paul A. Branstad
Joseph S. Bravman
James E. Brown III
William S. Brown
William L. Bunce
Jon E. Burkhardt
William O. Cain III
Thomas A. Casey, Jr.
Richard A. Clark
Peter M. Cukor
Ralph M. Davison
James C. Deckert
Steven H. Disman
Charles E. Fallen
Lewis H. Gaines
Andrew M. Glickstein
Paul G. Godfrey
Melvin H. Goldman
Kenton A. Griffin
Stephen M. Hoffman
Jonathan W. Hopkins
Stanley A. Horowitz
Thomas H. Hutzelman
Robert R. Jackson
Philip M. Jacobs
Kenneth J. Kepchar
Martin Krone
James P. Lavine
Michael R. Leavitt
Gerald B. Lichtenberger
David B. Liroff
Bruce A. Magnell
Henry H. Perritt, Jr.
Enrico C. Poggio
Barbara L. Pollack
Harold Porosoff
Thomas A. Rice
Michael D. Rinaldi
Ralph G. Schmitt
Mark S. Schwartz
Barry P. Skeist
Joseph I. Smullin
Frank E. Surma, Jr.
Stephen N. Teicher
John Torode
John H. Turner, Jr.
Tomas F. van Tienhoven
Robert A. Wells, Jr.
Edward C. Wert
Malcolm E. Wheeler, Esq.
Henry A. White III
Robert L. McCrory, Jr.
Marion L. Wood, Jr.
Robert S. Zucker

1967

John Acevedo
Enrico I. Ancona
Donald A. Belfer
Victor M. Bermudez, Jr.
Donald J. Bosack
William L. Caton III
John W. Cook
John M. Davis
Gordon J. De Witte
M. W. Dix, Jr.
Carl B. Doughty
Tomme W. Ellis
D. T. Engen
Kenneth G. Follansbee
Barbara A. Gilchrist
Lewis B. Golovin
Howard J. Greenbaum
Lawrence C. Hall
Alan B. Hayes
Edson C. Hendricks
Robert C. Hewitt
Alan R. Hirsch
Harold J. Iuzzolino
Martin S. Kohn
Charles E. Kolb, Jr.
Alan E. Kruse
Arthur C. Kwok
Andrew C. Lemer
Eric K. Li
Donald A. Mattes
John D. McClain
Susumu Mitarai
Charles V. Moran
Richard W. Munkelwitz
Victor Myev
Donald R. Oestreicher
Stuart H. Orkin
John S. Podolsky
Stephen J. Rawlinson
John C. Reykjal

Stanley M. Rose
George S. Sacerdote
Chester L. Sandberg, Jr.
John M. Shufelt, Jr.
Gerald B. Siegel
Melvin Snyder, MD
Karsten Sorensen
Neil D. Steinmetz, MD
Harry J. Strickland
James A. Swanson
Michael L. Telson
James C. Tsang
Bruce A. Twickler
Eugene L. Venturini
Glenn A. Wanek
Jeffrey M. Wiesen
John D. Wrigley, Jr.

1968

Harvey Allen
Piette T. Amstutz III
Paul F. Bente III
Richard E. Boyatzis
Marilyn M. Bruneau
Donald R. Bruns
Ronald P. Burd
Samuel A. Cohen
Fredda J. Cole
Shan Cretin
Vahe Davidkhanian
David J. Dimlich
Roy G. Dorrance III
Steven G. Finn
Paul A. Forbes
Julian P. Freret, Jr.
George M. Goldmark
Peter Groot
Daniel G. Gruber
Robert T. Haslam III
Jay J. Hellman
Robert C. Hendel
Brooks L. Hillard
James C. Hsia
Andrew A. Jennings, Sr.
James E. Just
Paul C. Kimball
Craig W. Kirkwood
Andrew J. Laurino
Robert Y. Li
John P. Linderman
Scott P. Marks, Jr.
Robert L. McCrory, Jr.
Scott J. Mermel
Juan M. Meyer
Charles B. Miller, Jr.
Paul L. Modrich
Jesper Munch
Thomas M. Murphy
William M. Parks
Claude H. Pope, Jr.
Richard E. Reese
Scott F. Richard
David J. Roberts
Joel P. Robinson
Ronald S. Rosen
Kenneth I. Rosenberg
Jack A. Russell
Benton H. Schaub, Jr.
Leonard H. Schrank
Andrew Seidenfeld, MD
Jonathan D. Shane
Robert M. Supnik
Kenneth P. Wacks
Randall J. Warniers
W. S. Wilson
Kenneth F. Wong
William G. Zink

1969

Burt S. Barnow
James H. Black, Jr.
Jose G. Bloch
Rolf Brauchler
Mark L. Braunstein
Paul D. Brophy
Charles W. Buezi, Jr.
David A. Cane
Marc Davis
Gary C. Dixon
Bruce R. Donath
Mark Drzen
Gary A. Ford
Matthew M. Franciewicz, Jr.
Jeffrey H. Grotte
Bruce K. Hamilton

Bruce L. Hefflinger
Stephen A. Hill
John M. Hirsch
Joseph A. Horton
Alan C. Huber
John F. Kasar
David P. Kelleher
Thomas H. Kick
Richard D. Kremsdorf, MD
Alan M. Kudler
Carl W. Kuhn, Jr.
Michael W. Laird
Stephen T. Lee
William D. Lee
Ronald J. Lepkowski
Mark B. Lively
John I. Loewenstein
Richard G. Marcus
Dean S. Musgrave
Edward L. Parsons, Jr.
Peter Peckarsky
Roy F. Quick, Jr.
Robert J. Randall
William L. Roberts
Franklin P. Rogers
Christopher R. Ryan
James J. Sanders III
Joel I. Seiferas
Richard G. Smith
Thomas E. Stewart
William T. Stewart
Walter P. Suchon
William H. Thomas, Jr.
Robert L. Tillman, Jr.
Michael P. Tinko
James P. Tritt, MD
Hal R. Varian
Jeffrey M. Weissman
Smith T. Wood
Wayne A. Zafft
Robert R. Zimmerman

1970

Richard A. Anderson
Frederic W. Andree
Olen R. Ashe, Jr.
Irving M. Asher
James M. Bards
Douglas F. Bender
Stanley Bone
James C. Bronfenbrenner
Paul H. Burstain
James L. Caldwell
Raymond C. Chung
Eric K. Clemens
Steven D. Colby
Joanne Cole
Carol Cunningham
David P. Dobkin
Irene du Pont III
John C. Eichelberger
William N. Follotte
James Fong
James S. Gaetjens
Carol A. Goldstein
Robert F. Gonsett
Marvin E. Greenberg
Elaine D. Gruber
John F. Havery
John C. Head III
Stanley L. Howard
Charles G. Hunter
Jimmy J. Jackson
Robert L. Jeffcoat
Nicholas S. Johnson
Mark B. Ketchen
David Koh
Peter H. Lee
Thomas W. Liu
Timothy D. Lundeen
Paul Manooian
James M. McCarthy
Daniel A. McElwee
John B. McLaughlin
William C. Michels
Daniel J. Paci
William B. Parsons
James M. Patel
David T. Patten
Anthony C. Picardi
Francesco Pompei
David M. Rapoport
Christopher L. Reedy
Robert F. Rorschach

Christopher M. Rose
James B. Rothnie, Jr.
Sandra A. Skiba
Stanley Smilack
Herbert F. Stevens
Stephen R. Takeuchi
Tyler B. Thompson
Marc Tipernas
Thomas G. Unger
Michael S. Venturino
Douglas M. Wells
Harold M. Wilensky
Man F. Yan
Carl J. Yankowski

1971

Richard A. Aparo
Kenneth A. Bauer
Robert F. Beckley III
Gregory K. Bernhardt
Joseph K. Boddiford, Jr.
Glen A. Brunk
Robert M. Churella
Bruce W. Cichowlas
Jerry L. Crutcher
Thomas H. Derby III
Charles C. Dillon
Paul L. Eggerman
Donald S. Feith
Benjamin P. Feng
Joseph N. Fields III
Edward T. Furrow
Steven M. Gilbert
Michael S. Gilmore
John J. Guiniven
John J. Halperin
Randolph G. Hawthorne
Tim S. Holner
Gim P. Hom
James A. Howell
Martin L. Jack
Stanley S. Kask, Jr.
Janet A. Koch
Ellen B. Koerber, MD
Jay S. Kunin
Jeffrey D. Kurtze
Gary H. Lantner, Esq.
David L. Lapidus
Peter D. Lebling
Robert P. Lidal
Robert E. Lindgren
Peter W. Lindner
John M. Malarkey
Timothy J. Maloney
Michael D. Mathers
Robert E. Miegel
Randall E. Moore
Kerry R. Mull
James G. O'Connell
Jaime L. Olmos
Kenneth W. Olson
Judith L. Piggins
Richard L. Plambeck
William H. Preece, Jr.
Robert H. Price
George W. Scherer
Lawrence E. Schmutz
Douglas W. Seitz
Florence H. Sheehan
Howard L. Siegel
Patrick B. Sullivan
William J. Swedish
Gus J. Vlahakes
Joseph B. Walters, Jr.
Peter J. Wender
Philip R. Widing
Robert D. Zellers

1972

Joseph A. Auer, Jr.
Douglas G. Bailey
Carliss Y. Baldwin
Bradley C. Billedeux
John M. Bissell
Kenneth M. Brown
Jack E. Cater
Terrill J. Cheng
Leonidas P. Colakis
Alan M. Cooper, MD
Wilhelm Daida
Bradford A. Dulmaine
Marshall B. Goldmin
Robert S. Goodof
James J. Gurley
Robert S. Hart

Patrick M. Heilman
James N. Heller
Mark A. Hlatky
Thomas J. Humphrey
Elizabeth A. Hutchins
John D. Kavazanjian
Hans W. Khimn
Norman V. Kohn
Lynn Mahony
Paul B. McBride
Daniel J. Nadler
Conor D. Reilly
Lawrence D. Rosenthal
Michael J. Rowny
James W. Rodo
Lynn M. Roylance
Steven K. Schuster
David Shpilberg
Leonard H. Sigal
Dean Solomon
Michael F. Sweeney
Ralph D. Witschey, Jr.
Albert S. Yee

1973

Clifton P. Allen
Arthur H. Barber III
Bertrand C. Barrois
Jay F. Benesch
John R. Bertschy
Roger P. Bowers
Johannes F. Christ
Mary J. Crooks
Robert G. Eccles, Jr.
Thomas E. Ellis
Henry I. Feuerstein
John R. Gersh
Mark S. Glasser
Mateo Go, Jr.
Paul A. Green II
Nicholas T. Hamisevicz
William P. Huffman III
Michael J. Jacobson
Elaine Kant
John E. Kaufmann
Roger D. Lace
Bernard J. Lange III
George R. Langlais
David Lee
Jack A. Levy
Patrick A. Marcotte
Howard Messing
Robert B. Millard
Stephen P. Miller
Joseph H. Mirzoeff
Frederic S. Mishkin
Gregory E. Moore
David J. Moylan III
Mark C. Oakes
David M. Otten
Forrest A. Price
Martin Romeo
David C. Simen
Alan G. Spoon
Alice M. Sprouse
Thomas R. Stagliano
Cynthia Day Stratton
Paul A. Swartz
William W. Toy
Dennis Tully
John C. Weaver
James S. Wiley III
David R. Wilson
John D. Wright
Charles A. Ziering, Jr.

1974

David C. Aldrich
James R. Andrew
M. M. Ansoor
Michael J. Apted
Edwin M. Arrippol
Anne E. Bossi
John R. Bush
Ludwig C. Chang
Yee-Wah Chin
Stephen J. Cucchiero
Piero D. Di Capua
Michael P. Filosa
David A. Fox
Roger N. Goldstein
Charles E. Granatir, MD
James R. Greff
Richard A. Hartman
Rodney C. Hartman
Michael J. Hassett
David H. Hawke

Charles E. Hillman
Bruce I. Judelson
Bruce A. Karmel
Gary G. Klein
Manuel A. Malagon-Fajer
Kenneth P. Minneman
Gary H. Miyashiro
Andrew W. Moehlenbrock
Berry N. Nelson
Patricia L. Newbold
Amos Oshrin
Gary L. Peskin
Seth M. Powsner
Gary D. Raymond
Laurence H. Reece III
John A. Ritter
Elizabeth P. Scheuren
Paul E. Schindler, Jr.
Bruce B. Schreiber
Paul J. Shapiro
David A. Shiang
Scott H. Shlechter
Marko M. Siuarczuk
Grant N. Smith
Dennis J. Solomon
Rinaldo A. Spinella
William W. Stargardt
Judith A. Stephens
Kevin Struhl
Jonathan B. Tepper
William H. Thoms
John P. Tierney, Jr.
Robert G. Turner
Jay W. Van Dwingelen
Denny O. Wang
Jeffrey C. Weinreb
Douglas W. White
William P. Zampol
Dirk A. Zwemer

1975

Richard A. Barron
Wesley S. Blank
Peter P. Blanshan
Jeffrey M. Broughton
Hon W. Chui
Eugene C. Ciccarelli IV
Harold M. Cook
Csaba Csere
Paul M. Davison
Kenneth M. Deemer
Loren E. Dessonville
Moray P. Dewhurst
Thomas Durgavich
Alan G. Epstein
Melvin B. Fegley, Jr.
Elliot J. Feit
Charles Fendrock
Frank P. Fezzie, Jr.
Robert J. Gandelman
Ilene S. Gordon
Henry G. Heck
Donald W. Inadomi, MD
Bakos A. Isaac
Pamela J. Jorgensen
Frank Klotz
Michael G. Kozinetz II
Thomas G. Leo
Alan E. Levin
Mark A. Lyne
Peter J. Mancuso
Robert W. Mann, Jr.
Richard J. McCarthy
Thomas F. McKim
James A. Moody
Arthur P. Rossiello, MD
Floyd P. Schultz
Donald E. Shobrys
John R. Stiehler
Arlo F. Weltge
John B. Wilbur III

1976

David A. August
Clark M. Baker
Joel M. Berez
Eric L. Bogatin
Rafael R. Medina
Donald B. Mellen
Teresa J. Nole
George M. Orlov
Barbara K. Ostrom
Anthony L. Otten
Nino F. Pedrelli
Robert G. Resnick

Jeffrey A. Grossman
Jeffrey S. Hallis
John J. Hanzel
Mark A. Holthouse
Douglas M. Johnston
Neil E. Kaden
Mark E. Keough
Lawrence Kernan
James W. Lambert
Campbell M. Lange
David L. Lee
Kelly P. McClellan
William H. Menke
Jerry D. Metz
Eric H. Michelman
Janis L. Ossmann
Joan M. Pendleton
Neil E. Rasmussen
Susan A. Riedel
Burt L. Rubenstein
Frank A. Ruiz
David C. Shaver
Lee M. Silberman
Susan L. Smolinski
John D. Starr
Jack H. Stevens
James P. Wajda
Gail M. Walker
John E. Wiele

1977

Charles B. Baltimore
Wayne D. Baron
William Baum
David R. Biebler
Carol H. Blohm
Glenn W. Brown, Jr.
Richard W. Buck
Michael C. Cohen
Robert S. Cotta
David A. Dobos
Peter C. Doerschuk
Leonard N. Evenchik
Thomas B. Fetter
Peter J. Fiekowsky
Samuel D. Gasser
Thomas C. Gooch
Michael J. Haney
Stephen W. Keith
Thomas A. Kush
Kevin B. Miller
Robert F. Miracky
Charles G. Mogged, Jr.
Timothy F. Morison
Daniel A. Nole
Robert M. Russ, Jr.
Richard M. Smiley
Steven H. Spiro
Daniel G. Sundberg
Leslie F. Sutton
Barbara A. Thornton
Leigh E. Watlington
William F. Whitelew

1978

Bradley S. Albom
Diana L. Barco
Howard S. Baron, Jr.
Kevin F. Brennan
Richard H. Brudnick
David B. Burstein
Alice E. Campbell
Trieu C. Chieu
Mark R. de Lemos
Fern L. DeVale
William T. Fejes, Jr.
Brian J. Frohring
James J. Heeger
Gary M. Heilgman
Jeffrey S. Hovis
James V. Impara
Thomas C. James
Timothy C. Jones
Susan L. Kayton
Jonathan R. Leeshey
John N. Little
Carl D. Lutz
Rafael R. Medina
Donald B. Mellen
Teresa J. Nole
George M. Orlov
Barbara K. Ostrom
Anthony L. Otten
Nino F. Pedrelli
Robert G. Resnick

Eric R. Shienbrood
Andrew A. Stern
John E. Swindle
Michael D. Waxman
Steven C. Webster
Scott R. Westbrook
Fred W. Wiley, Jr.
Arthur M. Wright

1979

Douglas C. Barnard
Lisa M. Bendixen
Louis A. Cohen
Susan J. Colley
Donald J. Devine, Jr.
Keith L. Dimorier
Jeffrey N. Dugal
Pryor A. Garnett
Robert E. Gompl
Norman R. Guivens, Jr.
Jan S. Hack Katz
David S. Heller
Daniel R. Helman
Dale V. Hodson
Daniel E. Jones
Donald Joe
Stephen K. Kenda
Emerson T. Knowles
Sally C. Kornfeld
Richard Kovalick, Jr.
Richard P. Kuntz
David R. Lewis
Robert A. Light
Gerald T. Michael
David D. Miller
James R. Murray
Eugene Novacek
Lee S. Parks
Branda Pomerance
Amy L. Powell
John F. Pries
Xing S. Quan
Bruce J. Roberts
Larry S. Rosenstein
Charles B. Rodo
Jeffrey J. Russell
Carlo R. Russo
David L. Tohir
Preston L. Vorlicek
Scott H. Wayne
Edmund L. Weston III
Eric N. Whitney
William T. Wood

1980

Frederick D. Baker
Jeffrey H. Berman
Jane Chronis
Mark F. Connaughton
Ann M. Connor
Thomas A. Curtis
Ralph A. Hulseman
Frank E. Huston
Jeffrey M. Jaycox
Barbara M. Johnston
Eric L. Kahn
Patrick F. Lattrell
Timothy J. McManus
Kathleen L. Mulrone
Terry S. Neiman
Scott A. Norton
James J. Olsen
Kenneth D. Oya
Brian J. Picht
Richard W. Tucker
William R. Welke
Walter J. Zielenski III

1981

Aaron F. Bobick
George J. Carrette
Lance H. Choos
Lauren A. Christopher
Walter R. Crosby
Warren J. Dew
Tso Yee Y. Fan
John R. Fierke
Ellen C. Fischer
Deborah A. Galaska
Joel T. Garcia
Mark Hellinger
Arthur D. Himle
Louisa Ho
Roger A. Ishimoto
Glenn L. Katz
Judith K. Lemire

Paul G. Mahoney
Charles I. McCauley
Duane T. Nakahata
William I. Ogilvie
David L. Pinckney
Colin P. Shepherd
Douglas S. Swanson
Armando E. Viten
Christopher S. Wheeler

1982

Anders T. Anderson, Jr.
Arno S. Bommer
Thomas J. Calderwood
Douglas M. Chin
Michael G. Feinstein
Charles Frankel
Cynthia A. Hale
Fred W. Helenius
Chris K. Johannessen
James E. Lewis
Grace L. Malloy
Matthew Prete
Philip B. Romanik
William L. Shiley
David I. Solo
David B. Teller
Chi-Won Yoon

1983

Erik R. Altman
Paul S. Cunningham
John E. De Rubis
Raymond E. Goldstein
Lawrence J. Kaufman
Kenneth W. Krugler
Barry Margolin
John E. Macek
John S. Richards III
Thomas G. Rucker
Rhonda J. Shaw
Patricia A. Smith
James E. Thomas, Jr.
Simon D. Trieu
Robert Varkonyi
Roy M. Weinstein

1984

Albert C. Bashawaty
Paul J. Bradford
Marcos E. Caro
Ralf Hartenack
Michael E. Landmeier

1985

John J. Friskopf
Michael M. How
Atul Jain
Jeffrey S. Moore
Stephen N. Schwoerke

1986

Steven L. Gaiser
Mary C. Ystueti
Alan D. Gordon
William H. Haseck
Thomas V. Sepez

Advanced Engineering Studies

Hyo-Joon Kim '76
Harold H. Leach '70

Aeronautics & Astronautics

William B. Abbott III '61
Richard L. Barkley, Jr. '68
Karl H. Bergey Jr. '51
Alan J. Bilanin '73
Hugh J. Campbell '53
Eugene E. Covert '58
Carlo N. De Gennaro '53
David W. Dove '71
Felipe M. Echaniz '43
Walter A. Foley '70
Howard J. Gibling '72
John T. Harduvel '72
James W. Harvill '64
Thomas J. Harriman '43
Elmer E. Larrabee '48
John W. Leech '57
Gaylord MacCartney '53
John J. Mahoney '54
James S. McDonnell III '59
Theodore H. Pian '48
John G. Ryan '60
Timothy J. Ryan '73
George S. Scharrer '35
Leroy P. Smith '49

Robert R. Sparacino '61
Hironori Takahashi '70
Alan L. Weinberger '61
Robert F. Weiss '59

Architecture

Muhammad Abdus-Sabur '78
Sarah K. Abrams '85
Takashi Arikawa '86
Leon E. Bailey '58
Edward J. Burnell III '66
Thomas D. Cabot III '82
Stephen M. Carr '61
Constantin E. Cavoukios '87
David K. Cole '85
John R. Dale '86
Charles F. Davis III '66
Alan B. Dolmarch '68
Chike J. Enwomwu '71
Gerald E. Ervin '59
Gordon K. Gonzales '85
Nancy L. Goodwin '74
Jeanne M. Goucher '85
Jeffrey H. Jacobson '87
Toufic E. Kadri '82
Ernest E. Kirwan '59
Don Klein '85
Eric A. Knapp '86
Terence S. Meehan '83
Marian Moffett '75
Laszlo I. Nemeth '67
Charles D. Nolan, Jr. '86
Rafael Obregon Herrera '72
Daniel A. Padrotti, Jr. '88
John W. Pearce '47
Anthony C. Platt '69
Richard C. Reese '50
Elliott Saltzman '51
William Schein '87
John I. Schlossman '66
Charles A. St. Clair '84
Norris Strawbridge '76
Peter C. Sugar '60
Ellen A. Watts '85
Ewart A. Wetherill '58
John A. Windsor '80

Biology

Russell K. Chan '74
Edward S. Josephson '40
Gregory J. Kaczorowski '77
Jacob Struck, Jr. '58
Alfred M. Webb '47
Joanne M. Williamson '78
Dyann F. Wirth '78
Helen H. Wong '75

Chemical Engineering

Thomas M. Bartos '85
William C. Beck, Jr. '62
Rowland S. Bevans '46
Nelson T. Bogart, Jr. '39
Pierre L. Brian '56
Michael C. Chen '73
Robert W. Davis '50
Bradley Dewey, Jr. '40
Robert H. Farías '51
John Forgione '50
Robert A. Frey '43
Howard Grekel '47
Arthur E. Higinbotham '60
Allen F. Horn '84
John D. Jacobs '34
George R. Jasny '52
Luis H. Jaw '57
Herbert Kay '47
William E. Kennel '47
William C. Krumrei '51
Yi H. Ma '67
Leo Maas, Jr. '40
Michael P. Manning '76
Terence C. McDonald '84
Edward W. Merrill '47
Carl S. Minden '47
Wang-Tse T. Mo '88
Timothy L. Montgomery '74
Albert L. Moore '58
William M. Murray, Jr. '55
James P. Noyes '53
John H. O'Neill, Jr. '51
Ralph R. Paxton '49
Donald W. Peaceman '51
Frank G. Pearce '46
Joel L. Plawsky '86
William A. Reed '43
John B. Roberts '36

Murray W. Rosenthal '53
George F. Schlaudecker '39
John P. Schmidt '63
Hugh W. Schwarz '42
James Seth '36
Yen Shen '42
Robert E. Siegfried '47
Frank W. Smith, Jr. '49
Robert S. Smith '47
Yihong Song '78
Tzeng J. Suen '35
Jefferson W. Tester '71
Hsueh-Rong Tong '81
J. E. Vivian '39
Willard F. Wadt '33
Charles K. Walker '40
James C. Wei '54
John A. Wilcox '77
Lucile S. Wilkens '77
Charles S. Windebank '37
Byron B. Woertz '39
Kwang J. Won '79
Patrick S. Wong '62
Larkin T. Wyers, Jr. '43
William W. Yuan '59

Chemistry

George A. Auld, Jr. '68
Lawrence N. Bell '68
Manson Benedict '32
Rene R. Bertrand '62
Kofi Bimpong-Bota '75
James J. Bishop '69
Clifton J. Blankley '67
Carl H. Brubaker, Jr. '52
Robinson D. Burbanck '50
Robert L. Cargill, Jr. '64
Steven A. Carlson '69
Ping S. Chu '80
Joseph Ciabattini '65
Howard S. Corey, Jr. '55
Glenn D. Daves, Jr. '64
Susan M. Davis '80
Donald R. Douslin '48
Hugh L. Dryden, Jr. '50
Gareth R. Eaton '72
Sandra Eaton '72
Julian D. Ellett, Jr. '70
Anthony B. Evmin '66
James S. Fordyce '59
Robert B. Giles, Jr. '44
Kenneth M. Gordon '76
Alban T. Halliwell '40
Thomas J. Hastings, Jr. '42
Paul F. Hogen '68
John W. Irvine, Jr. '39
Harbo P. Jensen '74
Frederick D. Johnson '50
Margaret Jones '43
Christopher E. Kalmus '72
Dieter H. Kleubert '71
Leo A. Landers '52
Gerald D. Leubach '50
Kin-Chun T. Luk '77
Stephen A. Monti '64
Harold R. Nace '48
Clark W. Perry '63
William D. Phillips '51
Alexander Pines '72
Joseph E. Rousseau, Jr. '52
Richard T. Ruettinger '68
Arnold M. Schwartz '74
Henry B. Sinclair '59
Donald M. Smyth '54
Richard L. Wasson '56
Frederick K. Watson '36
Emily L. Wick '51
Randall B. Wilson '79

Civil Engineering

Lionel Bauduy '69
Richard B. Bovee '70
Shing-Ching Chan '71
Francis Y. Chin '73
Raphael S. Daniels '59
William S. Dunbar '79
Terence M. Garvey '56
Justin J. Gershuny '53
Thomas F. Gilbane, Jr. '75
Robert J. Hansen '48
Robert L. Hardison '63
Kent A. Healy '63
Yoshihiro Ichikawa '68
Joseph J. Kaelin '86
Edward B. Kinner '70

Richard M. Kutta '80
Thomas D. Landale '54
Robert F. Lathlean '46
Norman W. Llewellyn '49
William O. Lynch '47
Chi-Kuo Mao '83
Fujio Matsuda '52
Johann H. Meier '38
Harley L. Moore III '73
William A. Moylan '80
Tavit D. Najarian '75
Edward E. Newman '57
Asaf A. Oazilbash '85
Ann B. Rappaport '76
Arthur C. Ruge '33
D. W. Ryckman '56
Neil S. Shifrin '80
John C. Stewart '80
William C. Stookey '51
Morris L. Thatcher '72
Max M. Ulrich '51
Senol Utku '59
Polyvios C. Vintiadis '61
Charles R. Walker '48
Leon R. Wang '65
Brian J. Watt '70
Louis M. Wenick '77
Stanley M. White '76
Robert L. Wilcox '55
Roger H. Wingate '37
Ing H. Wong '71
Michel H. Zaleski '71

Earth, Atmospheric & Planetary Sciences (includes Meteorology)

Carlton L. Bjerkas '77
Walter F. Bohlen '69
Albert M. Bottoms '62
Roger J. Breeding '70
Herman W. Cooper '79
Edward N. Lorenz '43
Lucy Ann A. McFadden '77
Carle P. Montgomery '77
Thomas B. Sanford '67
William A. Schneider '61
Charles C. Schnetzler '62
Raymond C. Staley '45
Scott D. Thayer '48
Theodore S. Young '71

Economics

George B. Baldwin '52
Ellen Burton '82
Leslie Cookenboo '53
Robert O. Crockett, Jr. '51
M. L. Curley '46
William Dellel '77
Harold E. Dreyer '52
Ann F. Friedlander '64
Vincent A. Fulmer '53
Vernon H. Grigg '54
Thomas G. Hall, Jr. '52
James W. Hanson '52
William W. Keeler '50
Ansfred L. Kolbe '79
Catherine L. Mann '84
Stephen Martin '77
J. W. Miller '48
Nicholas S. Perna '69
Charles J. Stokes '51
Paul N. Van de Water '75
Philip K. Verleger, Jr. '71
Arnold R. Weber '58

Electrical Engineering & Computer Science

Richard C. Booton, Jr. '52
Joseph Bordogna '60
Emmett H. Bradley '50
James D. Bruce '60
Ta-Kuan Chiang '61
William H. Crabtree '62
John R. Cummings '57
John E. Dawson '78
Jack Delmonte '34
Peter J. Denning '68
Charles A. Desoer '53
Anthony P. Di Vincenzo '47
Michael D. Donovan '84
Jon Doyle '80
Dieter M. Eisenlohr '59
Heinrich A. Ernst '59
Robert R. Everett '43
Gerald J. Farrell '73
Donald A. Feldman '82

Paul J. Fox '73
John P. Green, Jr. '61
Allen R. Gunion '60
Frederick L. Hafer '50
Thomas B. Hayes '40
Hung-Liang Hu '71
Mark Hubelbank '72
Frank Ianna '72
David L. Isaman '79
Philippe A. Jones '76
Nolan T. Jones '54
George E. Keith, Jr. '62
Robert W. Lawler '79
Allen W. Luniewski '80
Robert L. Massard '50
Terrence P. McGarty, Jr. '71
Charles W. Merriam III '55
Edgar A. Miller '67
John R. Mulhern '70
Paul M. Murphy '40
Carl E. Nielsen, Jr. '58
Eni G. Njoku '76
Edward R. Orser '49
Stewart D. Personick '70
Clark J. Reese '70
James R. Relyea '58
Murray A. Ruben '64
Joseph P. Rymor '80
Adel A. Saleh '70
Rudolph A. Schlais, Jr. '65
William M. Snyder, Jr. '39
Robert J. Spinrad '63
James R. Stinger '72
Robert Stricker '70
John D. Summers '84
James M. Tien '72
Mark A. Townsend '37
Paul Y. Tseng '86
John C. Ufford '75
Maurizio G. Vallauri '54
Dean H. Vanderbilt '70
Mac E. Van Valkenburg '46
James L. Walker '67
David C. Whipple '48
Frederick L. Pugliese '86
Katsumi Yamane '71
Henry J. Zimmermann '42

Graduate Management

Ollie J. Akel '67
Arthur P. Alexander '58
Thomas J. Allen '66
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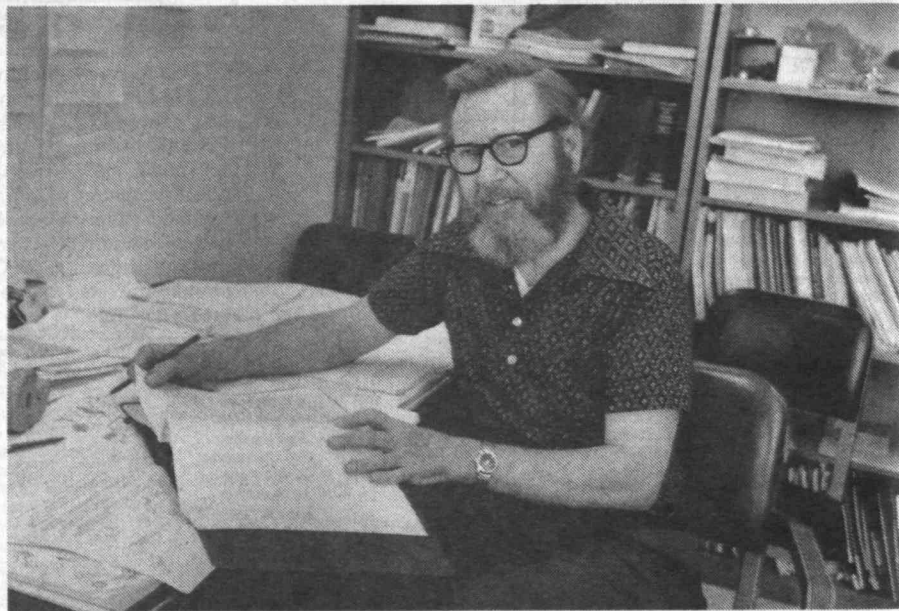
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Dick Adler

Richard B. Adler, 1922-1990

More than 800 people filled Kresge Auditorium on February 12 to share their memories of Professor of Electrical Engineering & Computer Science Richard Adler, '43, ScD '49, and to mourn his premature death. Adler died after he was hit by a car while out jogging near his Concord home on February 6. He was 67.

In the early 1960s, Adler established and then served as technical director of the international university-industry Semiconductor Electronics Education Committee, which first brought transistor-based, solid state electronics into undergraduate engineering education. In 1986, the IEEE recognized his singular achievement by awarding him its Education Medal, noting that Adler's work "totally reshaped the teaching of electronics throughout the country."

Adler collaborated with Professors Robert Fano, '41, and Lan Jen Chu, '35, on two of the ground-breaking engineering texts introduced at MIT in the late 50s: *Electromagnetic Fields, Energy and Forces*, and *Electrical Energy Transmission and Radiation*. Fano remembers that "[Adler's] pencil was a sensitive indicator of faulty reasoning."

From 1978-89, Adler was associate head of EECS, the largest department at MIT. In that post, he played a major role

in securing support for the Microsystems Technology Laboratories, and last fall he became a co-director of the laboratories. He was the first holder of the Distinguished Professorship in EECS and previously was the Cecil E. Green Professor of Electrical Engineering.

Speakers at the memorial service included President Paul Gray, '54, who was first a student and then a research assistant in Adler's group. Gray particularly remembered working with Adler on the Task Force on Educational Opportunity in the late '60s, which developed MIT's plan to enhance minority enrollment. In discussions that Gray characterized as "tempestuous" and "highly charged," he remembers that "Dick's evident moral and ethical authority" stood out.

That Adler's moral authority was evident in action as well as words was illustrated in a letter from David Johnson, '91, one of many whose lives Dick touched but who could not be at the service. "I know Richard Adler, the man whose intellectual achievements were surpassed only by his capacity for caring," Johnson wrote. "I know the Richard Adler who did not see my Blackness as my defeat. Instead, [he] understood that as a Black student, I had to learn in a hostile environment. So [he] provided the extra support that I needed."

Adler "didn't so much walk from place to place as he diffused from one conversation to another," wrote Professor Stephen Senturia, PhD '66. The flip side of that constant contact with students and colleagues, of course, was that Dick was routinely late for meetings. Former chairman of EECS Joel Moses, PhD '67, coined the term "the Adler Shift," to describe the 7-to-12-minute lag between the time any meeting was scheduled to begin and the time Dick Adler arrived. At the same time, Moses, whose doctorate is in mathematics and who served for 11 years as head of EECS, said Adler was a "warm and caring advisor . . . my personal tutor on many aspects of this department."

The memorial service was attended by his widow, Dorothy Gordon Adler—for many years a staff member of the Association of MIT Alumni and Alumnae and presently the coordinator of alumni recognition selection—and their three sons, and by friends and colleagues from both within and outside the MIT community.

In more than an hour of emotion-charged remarks, one that stood out came from Bobby Solow, wife of MIT economist Robert Solow. The Solows and Adlers were friends for more than 40 years. "When I skied down the slope behind Dick," Bobby wrote, "I skied better than I ever did in my life. Some of his grace seemed to rub off on me." That effect was not limited to the ski slopes; it was observed in the laboratory and the classroom as well. □

Horacio Caminos, 1914-1990

Horacio Caminos, professor of architecture at MIT from 1961-1984, died in his home in Newton, Mass., on February 18 after a long illness. He was 75.

He was the designer of buildings and architectural complexes in several countries, including the master plan for the Universities of Buenos Aires in Argentina and Los Andes in Merida, Venezuela. However, the real focus of Caminos' work was settlements for the poor. Beginning in the mid-1960s, he designed dwellings and sites in Colombia, Puerto Rico, Kenya, Lebanon, Guatemala, and El Salvador.

In 1965, with a grant from the Ford Foundation, Caminos created a program

in the MIT School of Architecture and Planning that trained students from developing countries in urban settlement design.

Caminos was born in Argentina and received a degree in architecture in 1939 from the University of Buenos Aires. Before joining the MIT faculty, he taught for 10 years at the University of Tucuman in Argentina, was associated with the Architectural Association of London's School of Architecture in 1952, and taught for nine years at North Carolina State College.

Among his publications are his 1978 book with Reinhard Goethert called the *Urbanization Primer*, which covers project assessment, site analysis, and design criteria for projects in developing areas, and *Education or Catastrophe*, published recently in Argentina, which expresses his belief that education offers one of the few reliable solutions to the world's problems. □

Philip Mandel, 1920-1989

Philip Mandel, a member of the faculty in ocean engineering from 1957 until his retirement in 1980, died December 18 at age 69.

Mandel was a 1942 graduate of the University of Michigan, with degrees in naval architecture and mathematics. For the next 15 years he was a naval architect with the U.S. Bureau of Ships.

At MIT his research interests were in ship maneuvering, control and seakeeping, and in ship design. He was the author of two texts: *Ship Maneuvering and Control* and *Water, Air, and Interface Vehicles*. He was an active member of the Society of Naval Architects and Marine Engineers, twice winning its award for outstanding professional papers. □

H. Philip Whitaker, 1921-1989

H Philip Whitaker, '44, a professor of aeronautics and astronautics from 1959 until his retirement in 1983, died on November 23 after a long illness. The 68-year-old Whitaker was a pioneer in the development of automatic flight control systems for airplanes and rockets, and he lectured on the topic throughout the world. In 1947, he joined the MIT Instrumentation Lab under then-director

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Charles Stark Draper, '26, and they were colleagues for the rest of Whitaker's career.

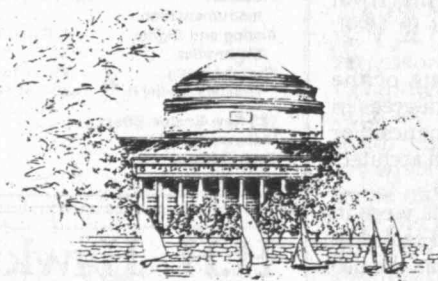
Whitaker, who received the master of science degree in Course XVI in 1959, was a member of the Advisory group for Aerospace Research and Development of NATO from 1968 to 1977. □

Deceased

The following deaths have been reported to the Alumni Association since the *Review* last went to press:

Harold S. Wilkins, '14; January 11, 1990; Lancaster, N.H.
Albert W. Demmler, '20; November 26, 1989; New Kensington, Penn.
John P. Lynch, '20; January 8, 1990; Sandwich, Mass.
Joseph L. McGuigan, '20; December 13, 1989; Alexandria, Va.
Edward P. Wylde, '21; January 7, 1990; Naples, Fla.
Philip M. Hastings, '22; December 16, 1989; Gaithersburg, Md.

Wallace L. Howe, '22; January 4, 1990; West Boylston, Mass.
Samuel H. Reynolds, '22; January 26, 1990; Carmel, Calif.
Bertram A. Weber, '22; December 17, 1989; Highland Park, Ill.
Salvatore A. Guerrieri, '23; February 21, 1990; Wilmington, Del.
Julian A. Joffe, '24; February, 1990; Gainesville, Fla.
Douglas B. Martin, '25; January 19, 1990; Farmington, Mich.
Francis J. Mulcahy, '25; January 12, 1990; Andover, Mass.
Frank W. Preston, '25; February 7, 1990; Stonington, Conn.
Arnold R. Marshall, '26; January 12, 1990; Hudson Falls, N.Y.
Ezra C. Trumbull, '26; June 9, 1989; Crestview, Fla.
Samuel A. Kaswell, '27; January 5, 1990; Tamarac, Fla.
Charles H. Kingsbury, '27; September 11, 1988; Palm Harbor, Fla.
Frank Massa, '27; January 2, 1990; Cohasset, Mass.
Daniel E. Sullivan, '27; September 16, 1989; Bronx, N.Y.
Leslie J. Weed, '27; March 3, 1990; Wellesly, Mass.



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Larger gifts can be used to establish a named endowment fund as a permanent memorial. If you would like information on ways of expressing sympathy through a memorial contribution, or on establishing a named endowment fund, please contact Betsy Millard, MIT Room E38-202, Cambridge, MA 02139 or call (617)253-8059.

Transferring Liquid Assets

Sid Shapiro thinks that I should have had a poll for "best problem of the decade." Well, better late than never: the polls are open! Mr. Shapiro's favorite was the short conversation between a Mr. P, who knew the product of two integers, and Mr. S, who knew their sum, from which one could deduce the two numbers.

Due to space limitations this issue, we will have only four problems.

Problems

M/J 1. Doug Van Patter reports that most declarers in the 1989 Cherry Hill Regional failed to make six hearts on the deal shown below. West leads the jack of diamonds (his highest card). Is there a chance of making 12 tricks?

North
 ♠ A 8
 ♥ Q J 10 4 3
 ♦ K 10 6
 ♣ A K 10

South
 ♠ 5 3
 ♥ A K 7 5 2
 ♦ A 7 4
 ♣ Q J 5

M/J 2. Randall Whitman proposes the following generalization of 1989 F/M 2. For each positive integer n , consider writing the integers from 1 to n inclusive and let $f(n)$ be the number of times the digit 1 was used. For what values of n does $f(n) = n$?

M/J 3. Richard Hess has a drinking problem he wants us to help him solve. Consider three containers that hold 15 pints, 10 pints, and 6 pints. The 15-pint container is full and other two are empty (15,0,0). Through transferring liquid among the containers you are to measure out exactly 2 pints to drink, drink the 2 pints, and continue transferring liquid to end up with 8 pints in the 10-pint container and 5 pints in the 6-pint container (0,8,5).

M/J 4. Gordon Rice wants you to extend the following sequence of Pythagorean triangles at least four more steps.

3	4	5
20	21	29
119	120	169
696	697	985
4059	4060	5741
23660	23661	33461

Speed Department

SD 1. Edward Wallner wants to know how Archbishop Whitgift could have died on 29 Feb 1603?

SD 2. Another calendar quicky. This one, from Alex Okun and Gene Lieberman, was transmitted by Speedy Jim Landau. The "October Revolution" in Russia began on 24 October 1917. What day of the week was that?

Solutions

JAN 1. Doug Van Patter offers us a real life bridge problem from the 1988 Lancaster Regional.

You (South) are declarer in a shaky 3 NT contract. West's opening lead of seven of clubs is taken by your eight. What line of play will give you a reasonable chance for nine tricks?

North
 ♠ K 7 6 4 3
 ♥ A 7 6
 ♦ 9 3
 ♣ K 10 6

South
 ♠ J
 ♥ K Q J 10
 ♦ A K 6 2
 ♣ J 8 3 2

The following solution is from John Chandler: Having taken the first trick, declarer needs only eight more, including four sure hearts and two sure diamonds. It comes down to promoting one more club and one spade. West clearly starts out with at least ace, queen, 9, and 7 of clubs, so the lead of the 7 is a conventional "fourth from the longest and strongest suit." Thus, it would be reasonable to suppose that East has the ace or queen of spades, unless West has only a few spades. I think the best play is to lead the jack of spades and let it ride. If East takes the trick with the ace, that sets up Dummy's king; if East takes it with the queen, we haven't lost much, particularly if East also has the ace. Indeed, if West has both ace and queen, that either lets the jack win or (more likely) clears the ace to set up Dummy's king. In any case, that makes it about 50-50 on setting up a spade trick right off, and the aftermath still holds the possibility of the defenders cashing the ace of spades for want of the 10, 9, or 8. It's easy enough to collect another club trick by leading a small one from South—that essentially forces West to play the ace, making Dummy's king

of clubs good.

Also solved by Robert Bart, Amy Lowenstein, Matthew Fountain, Gordon Rice, and the proposer.

JAN 2. Walter Cluett wants us to solve Filene's 1985 Christmas problem.

Among the shoppers one snowy Saturday morning were members of "December 25," a Christmas shoppers' club of 12 married couples. A clerk waited on all 12 couples consecutively, as they bought a total of 8 each of the following items:

1. Gloves
2. Book
3. Perfume
4. Pearl Strands
5. Football Sweater
6. Handbag

Each husband and wife were waited on together. Each couple bought 4 items. No two couples bought the same combination of items, and none of the couples bought two or more of the same item. Using the following clues, can you determine:

1. The full name of each husband and wife
2. What order they were waited on
3. What items each couple bought

The Clues

Hint: One husband is Bob; one wife is Elizabeth and one surname is Stanton.

1. The Craigs, who bought a handbag, were waited on before the Murphys, who were not waited on last.
2. The Collins bought gloves, a sweater, a handbag, and perfume.
3. The couples waited on 8th and 10th bought a book.
4. These five couples were waited on consecutively: the Smiths, Gary and his wife, a couple who bought a book and a handbag, the Swains, and Bill and his wife.
5. Geraldine and her husband did not buy either a handbag or a sweater.
6. The couple who were waited on last did not buy pearls.
7. One of the items Tom and his wife bought was a book.
8. The Marshalls did not buy perfume or pearls.
9. Evelyn and her husband bought gloves but not perfume.
10. These five couples were waited on consecutively: Martha and her husband; Jack and his wife; the couple who bought gloves, perfume, a book, and a handbag; the couple who did not buy either pearls or a book; and Margaret and her husband.
11. The first five couples waited on all bought perfume.
12. Chuck and his wife did not buy gloves.
13. The couples waited on first, second and fourth did not buy a sweater.
14. Eleanor and her husband did not buy perfume.
15. Neither Allen and his wife, who did not buy a handbag, nor the Anthonys bought gloves.
16. Cheryl and her husband, who were not waited on 10th or 12th, and John and his wife are two couples who bought both a sweater and a handbag.
17. The Douglasses, who did not buy gloves or a sweater, were waited on 9th.
18. Adam and his wife, who did not buy a handbag, were waited on immediately before the Days.
19. Steve and his wife bought pearls, a book, a sweater and one other item.
20. The last three couples waited on did not buy gloves.



SEND PROBLEMS, SOLUTIONS, AND COMMENTS TO ALLAN J. GOTTLIEB, '67, THE COURANT INSTITUTE, NEW YORK UNIVERSITY, 251 MERCER ST., NEW YORK, N.Y. 10012.

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Gretchen A. Young, '86
Christian de la Huerta, '87

21. The Joneses did not buy a sweater.
22. Susan and her husband bought pearls.
23. George and his wife bought a sweater.
24. The four couples who did not buy gloves are (in no particular order): Dorothy and her husband; the Craigs; Joe and his wife; and Rosalyn and her husband (who did not buy a sweater).
25. The O'Connors bought both perfume and a sweater.
26. Sandra and her husband, who did not buy a sweater, were waited on immediately before Cathleen and her husband.

This problem was popular in two senses: Many readers solved it and many said it was enjoyable. However, describing the solution technique was not easy. Several readers gave detailed accounts of their reasoning but the results seem too long to print. Also available, thanks to our proposer Walter Cluett, is a solution prepared by the original contest organizers. Although this solution is nicely typed and of appropriate length (but still a little long), I prefer to use one of our own solutions. I am giving Michael Baumann's, which was a good example of the summaries that several other solvers furnished.

Baumann's solution follows:
Please see chart (at bottom of page). Detailing how the solution was obtained would be quite laborious. Suffice it to say that I started by determining the surnames, what order they paid for their purchases, and to some extent, what they purchased. Once the couples were ordered correctly, it was fairly easy to go back and assign first names and fill out what was purchased.

Also solved by Robert Bart, Mary Lindenberg, Allen Wiegner, Sander Liehsten, Frank Binns, Raisa Deber, Susan Levitin, Samuel Levitin, Reba Hite, Tom Lydon, Donald Eckhardt, Amy Lowenstein, Randy Koloch, John Chandler, Steve Feldman, Bob High, Charlie Mason, Larry Bell, Laura Fricke, Loren Bonderson, Ray Gamino, Matthew Fountain, Libbie Merrow, Michele Rosen, Harry Zarembo, Julie Sussman, Jim Klucar, and the proposer.

JAN 3. Dave Mohr asks a discrete variant of 1988 M/J 2.

Two gamblers, you and Low Stakes, tire of dice and poker. You agree to wager on each of a number of plays of a game with the following set of rules: Each would write privately on a slip of paper three nonnegative integers whose sum must be 10. Zero is allowed (0, 2, 8 for example). Repeats are also allowed (3, 3, 4 for example). Then you compare amounts, largest against largest, smallest against smallest, and median against median. If any tie, the bet is a draw. The one with the larger amount in 2 of the 3 categories wins the wager. According to what strategy do you plan to select the numbers?

Several readers pointed out that considerations of bluffing and estimating the ability of your opponent are non-mathematical considerations that also apply. Gordon Rice included the following comment with his solution:

This problem is no more discrete than 1988 M/J 2, but it is more manageable. The earlier problem used integers up to 1,000, so it wasn't practical to build the payoff matrix. The result was that we got sucked off on a tangential issue. Like others, I approximated the finite solution by a continuous one, and tried to solve the calculus problem of finding which combination was the winningest, assuming that my opponent was idiot enough to choose his play at random from all possibilities. I almost got it, but there was a little area in the upper left where I couldn't complete the proof. I was disappointed to find that the published solution didn't help me with the difficulty.

Bob High noticed that for $n < 10$ there is an optimal solution consisting of always writing the same triple on your piece of paper, a so-called pure strategy. High's solution for $n \geq 10$ follows: I wrote a program to test for optimal mixed strategies for larger values of n . My program tells me that the solution for $n = 10$ is the strategy mixing (6,4,0), (6,2,2), and (4,4,2) in equal parts. So $n = 10$ is in fact the first interesting case (the first requiring a mixed strategy). The full game matrix for the $n = 10$ version of the game is given by: (see chart at top of facing page).

Since the sum of the entries in the 7th, 9th, and 13th rows (corresponding to the three pure strategies we want to mix) is always ≥ 0 , it is clear that the proposed mixed strategy is optimal.

In fact, there are optimal mixed strategies made up of equal parts of exactly three pure strategies for every value of n from 10 to 21. Sometimes there are several; for example, for $n = 12$, both (8,2,2), (7,5,0), (5,4,3) and (8,2,2), (6,6,0), (4,4,4) work. Sometimes there is only a single such strategy; the solution for $n = 10$ is unique, and for $n = 20$, the only solution I found was (12,5,3), (10,9,1), (8,7,5). The structure of the solutions, as proportions of n , seems pretty stable, but for $n = 22$, there is no such simple mixed strategy with only three components. I don't know what all this says about possible solutions to the continuous version—I had hoped the discrete solutions might converge to a continuous solution, but I don't know where the discrete solutions go for higher values of n .

Also solved by Robert Bart, Allen Wiegner, Sander Liehsten, Tom Lydon, Michael Baumann, Ken Rosato, Ken Haruta, Matthew Fountain, Harry Zarembo, and the proposer.

JAN 4. The following problem is from the book *The Puzzling Adventures of Dr. Ecco* written by my NYU colleague Dennis Shasha.

"Receiving a telegram these days is most unusual," Ecco said as he tore open the envelope. After reading the message, he said, "The contents are even more so. What do you make of it, Professor?"

The telegram read: DR ECCO NEED YOUR HELP ON RIDDLE STOP BELIEVE IT FROM GREEK MYTHOLOGY STOP WILL CALL ON YOU TO-

JAN 2 FIGURE

Order	Husband	Wife	Surname	Handbag	Book	Sweater	Pearls	Gloves	Perfume
1	Adam	Geraldine	Jones		X		X	X	X
2	Bob	Martha	Day	X			X	X	X
3	Jack	Susan	O'Connor			X	X	X	X
4	Tom	Sandra	Smith	X	X			X	X
5	Gary	Cathleen	Collins	X		X		X	X
6	John	Margaret	Marshall	X	X	X		X	
7	George	Cheryl	Swain	X		X	X	X	
8	Bill	Evelyn	Stanton		X	X	X	X	
9	Chuck	Rosalyn	Douglas	X	X		X		X
10	Steve	Eleanor	Craig	X	X	X			
11	Allen	Dorothy	Murphy		X	X	X		X
12	Joe	Elizabeth	Anthony	X	X	X			X

(10,0,0)	0	0	0	-1	0	-1	0	-1	-1	0	-1	-1	-1	-1
(9,1,0)	0	0	0	0	0	-1	0	-1	-1	0	-1	-1	-1	-1
(8,2,0)	0	0	0	0	0	0	0	-1	0	0	-1	-1	-1	-1
(8,1,1)	1	0	0	0	1	0	1	0	-1	1	0	-1	-1	-1
(7,3,0)	0	0	0	-1	0	0	0	0	1	0	-1	0	-1	0
(7,2,1)	1	1	0	0	0	0	1	0	0	1	0	-1	-1	-1
(6,4,0)	0	0	0	-1	0	-1	0	0	0	0	0	1	0	1
(6,3,1)	1	1	1	0	0	0	0	0	0	1	0	0	-1	0
(6,2,2)	1	1	0	1	-1	0	0	0	0	1	1	0	0	-1
(5,5,0)	0	0	0	-1	0	-1	0	-1	-1	0	0	0	1	1
(5,4,1)	1	1	1	0	1	0	0	0	-1	0	0	0	0	1
(5,3,2)	1	1	1	1	0	1	-1	0	0	0	0	0	0	0
(4,4,2)	1	1	1	1	1	1	0	1	0	-1	0	0	0	0
(4,3,3)	1	1	1	1	0	1	-1	0	1	-1	-1	0	0	0

JAN 3 FIGURE

MORROW AFTERNOON END.

"You are something of an amateur scholar of Greek mythology, aren't you?" I asked, pointing to a row of books.

"Quite amateur, indeed," Ecco responded modestly, "but considering the tone of this telegram, possibly more knowledgeable than our client, who may even now be pressing the doorbell."

The young man at the door looked very athletic with his polo shirt and tanned face. After introductions, he explained his problem.

"The woman I love is a graduate student in Greek literature," he said. "Her latest eccentric demand is that I solve a riddle adapted from her researches. She will marry me if I can answer three questions. Will you listen?"

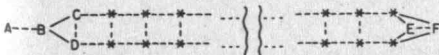
"By all means," said Ecco. "Please proceed."

"There is a party," said the young man, launching into the riddle. "Everybody at the party has shaken hands with three of the other people, except for one person, who has shaken hands with only one of the other people."

"That's all the information you get, Dr. Ecco." Then he stated the three questions.

1. What is the smallest number of people who could be at such a party?
2. Could there be 21 people at such a party?
3. Is there a general pattern of how many people could be at such a party?

As many readers pointed out, a very simple counting argument shows that the number of people must be even and an easy analysis shows that four people are not sufficient. The only real challenge was to find out which even numbers exceeding four are possible. Larry Bell showed that solutions exist for all such numbers. He drew the diagram below where A-F are always included (giving a six-person solution) and that pairs of stars can be added to give one more rung in the ladder (and a solution for the next even number).



Also solved by Avi Ornstein, Robert Bart, Donald Eckhardt, Mary Lindenberg, Amy Lowenstein, Peter Tzanetos, John Chandler, Michael Baumann, Allen Wass, Bob High, Ken Rosato, Matthew Fountain, Gordon Rice, Harry Zarembo, Frank Carbin, Susan Levitin, and Samuel Levitin.

Better Late Than Never

1989 JUL 1. Thomas Turnbull solved this problem on time. I mistakenly thought it was a new Bridge problem and misfiled it.

A/S 1. Juan Lavalley has responded.

A/S 2. Donald Eckhardt writes to say that the magic square shown is a de la Loubere magic square, named after Simon de la Loubere who, while in the service of the government of Louis XIV, learned the technique during a 1687 visit to Surat, India (at that time a major port just north of Bombay, which was then just a swampy little village). Eckhardt has written a paper on these magic squares that will soon appear in *Mathematics Magazine*.

Matthew Fountain and the proposer, Ronald Martin, note that the published solution does not

meet the requirement that all the diagonals sum to 671. The following solution, from the proposer, does meet this requirement.

11	25	50	75	89	114	18	43	57	82	107
12	37	62	87	101	5	30	55	69	94	119
24	49	74	99	113	17	42	56	81	106	10
36	61	86	100	4	29	54	68	93	118	22
48	73	98	112	16	41	66	80	105	9	23
60	85	110	3	28	53	67	92	117	21	35
72	97	111	15	40	65	79	104	8	33	47
84	109	2	27	52	77	91	116	20	34	59
96	121	14	39	64	78	103	7	32	46	71
108	1	26	51	76	90	115	19	44	58	83
120	13	38	63	88	102	6	31	45	70	95

OCT 1. Joe Feil has responded.

N/D 2. Bruce Kulik has responded.

Proposers' Solutions to Speed Problems

SD 1. At that era in England years started on 25 March but the leap years still fell when the year starting 1 January was divisible by four [Learn something every day—ed.].

SD 2. That was 24 October in the Julian calendar, which after 1900 was lagging the current Gregorian calendar by 13 days. Hence the revolution began 6 November according to our calendar, which straightforward counting shows to be a Tuesday.

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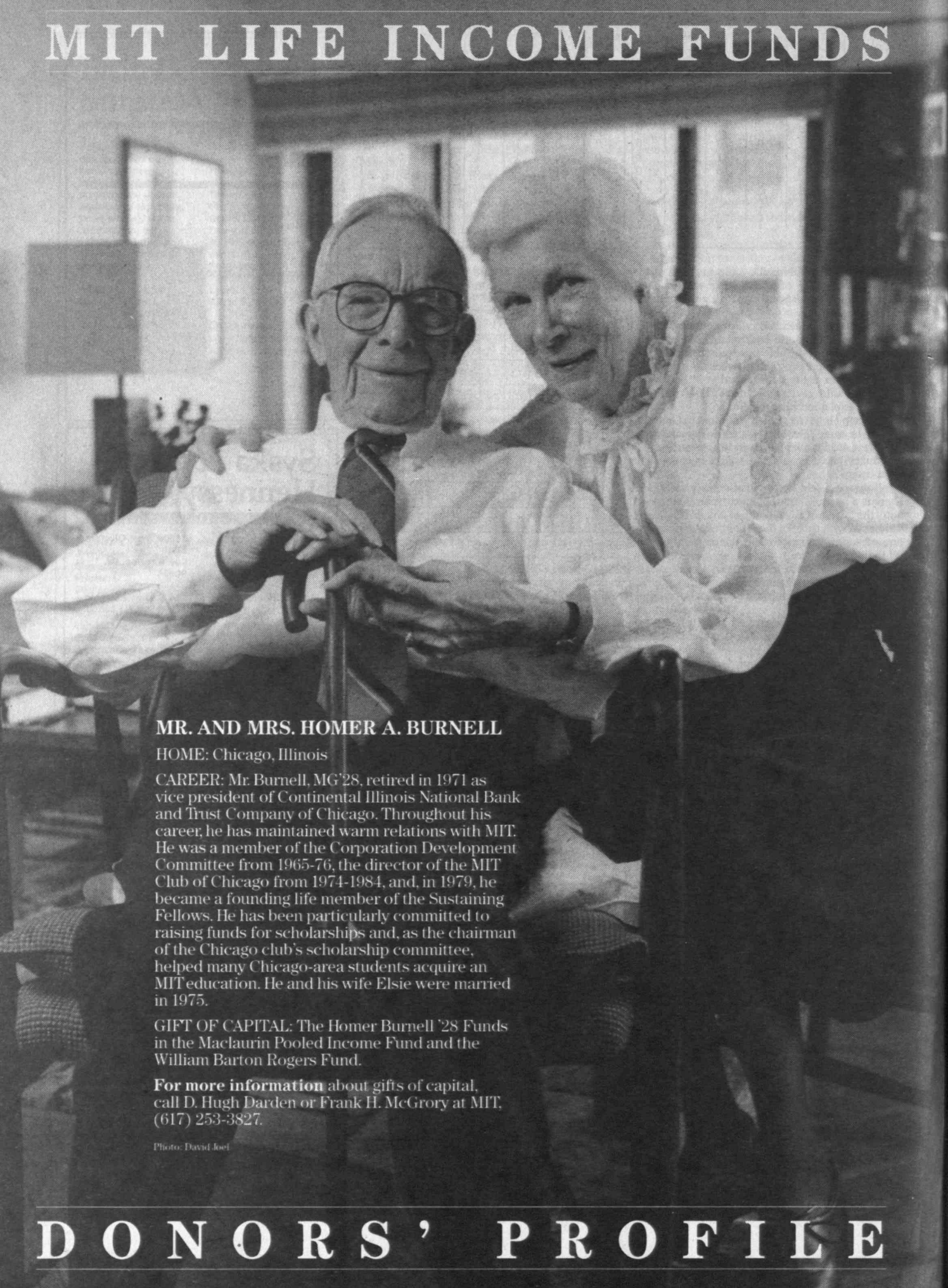
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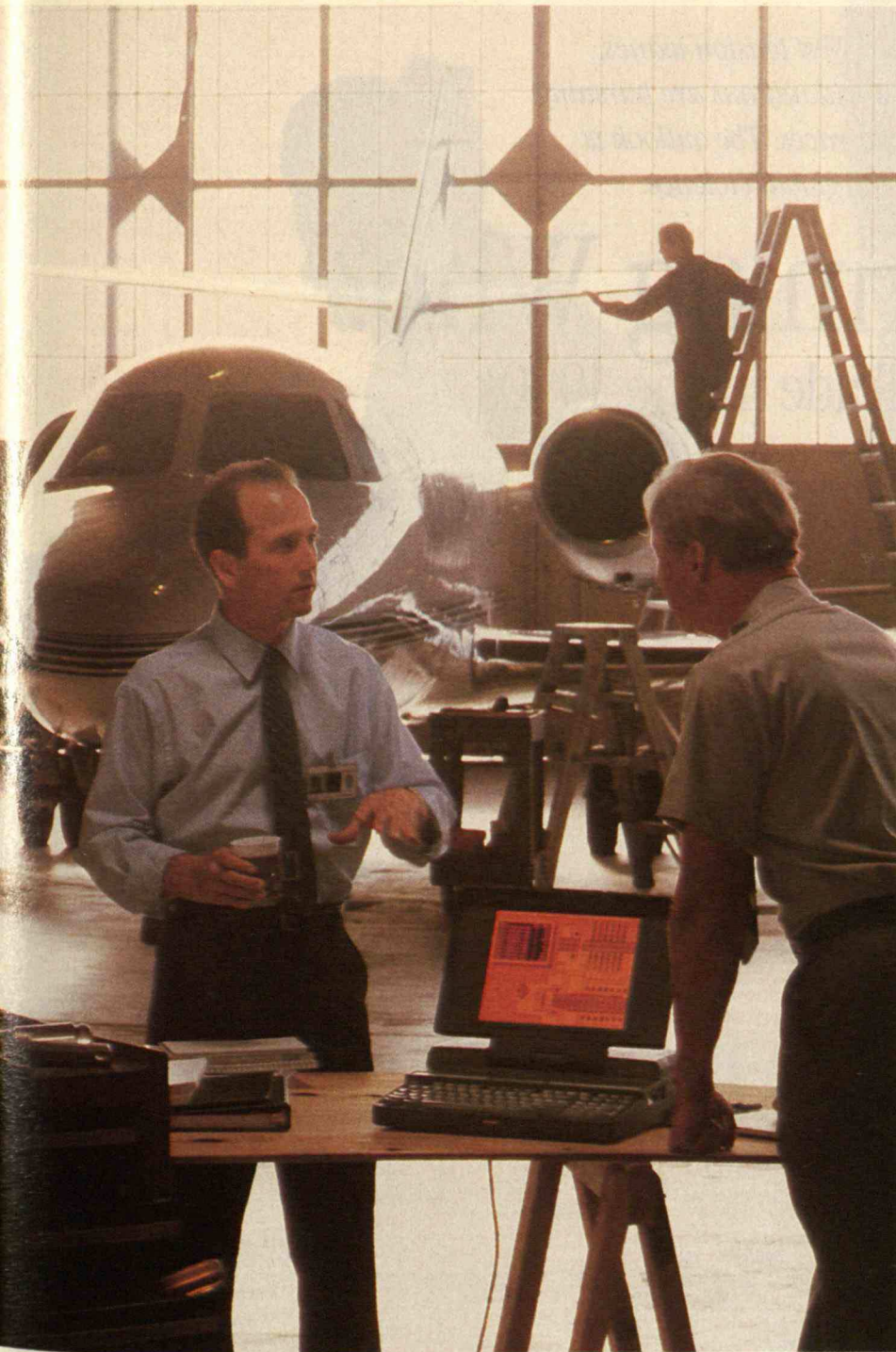
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*Even as East-West tension wanes,
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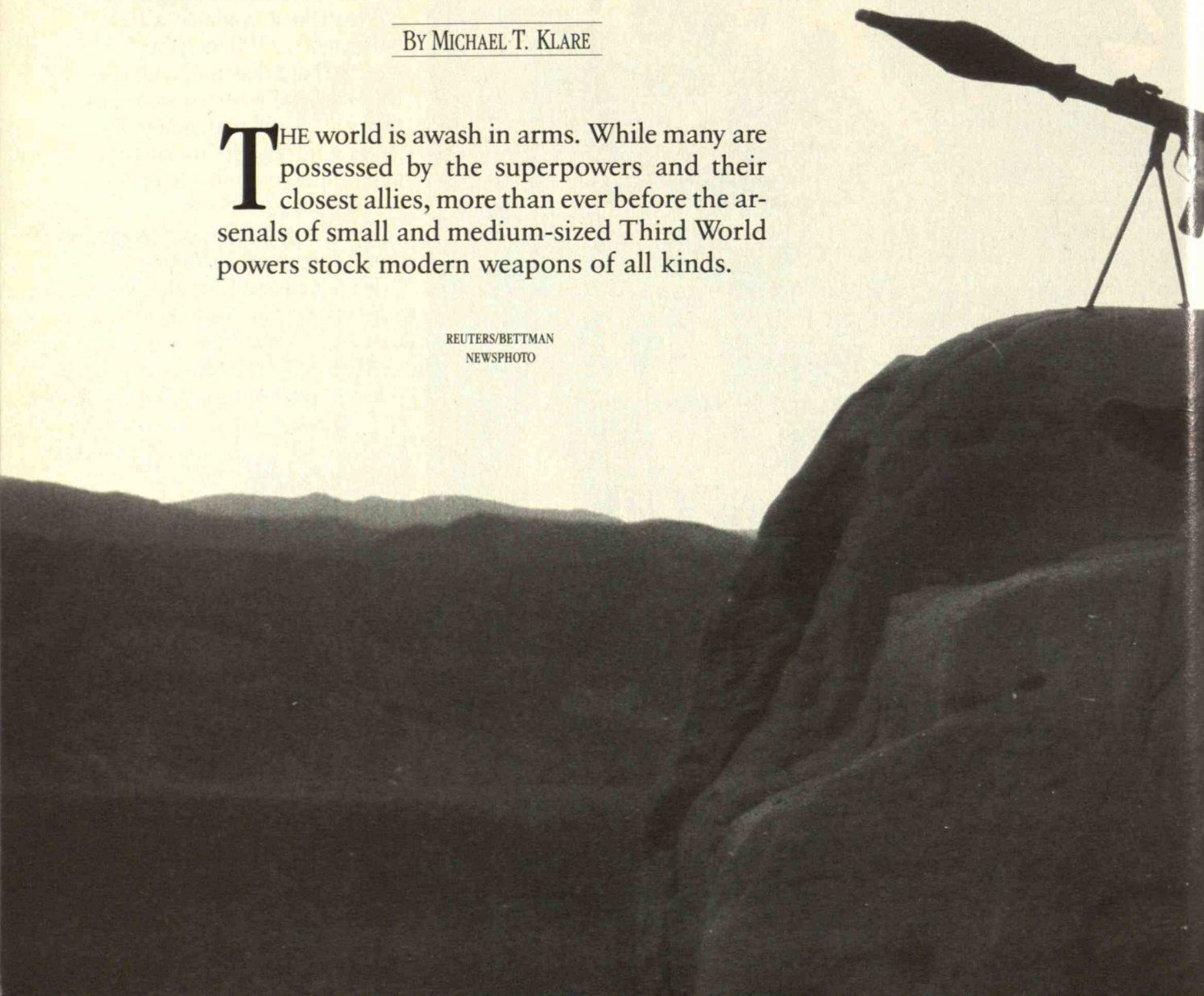
Who's Arming Who?

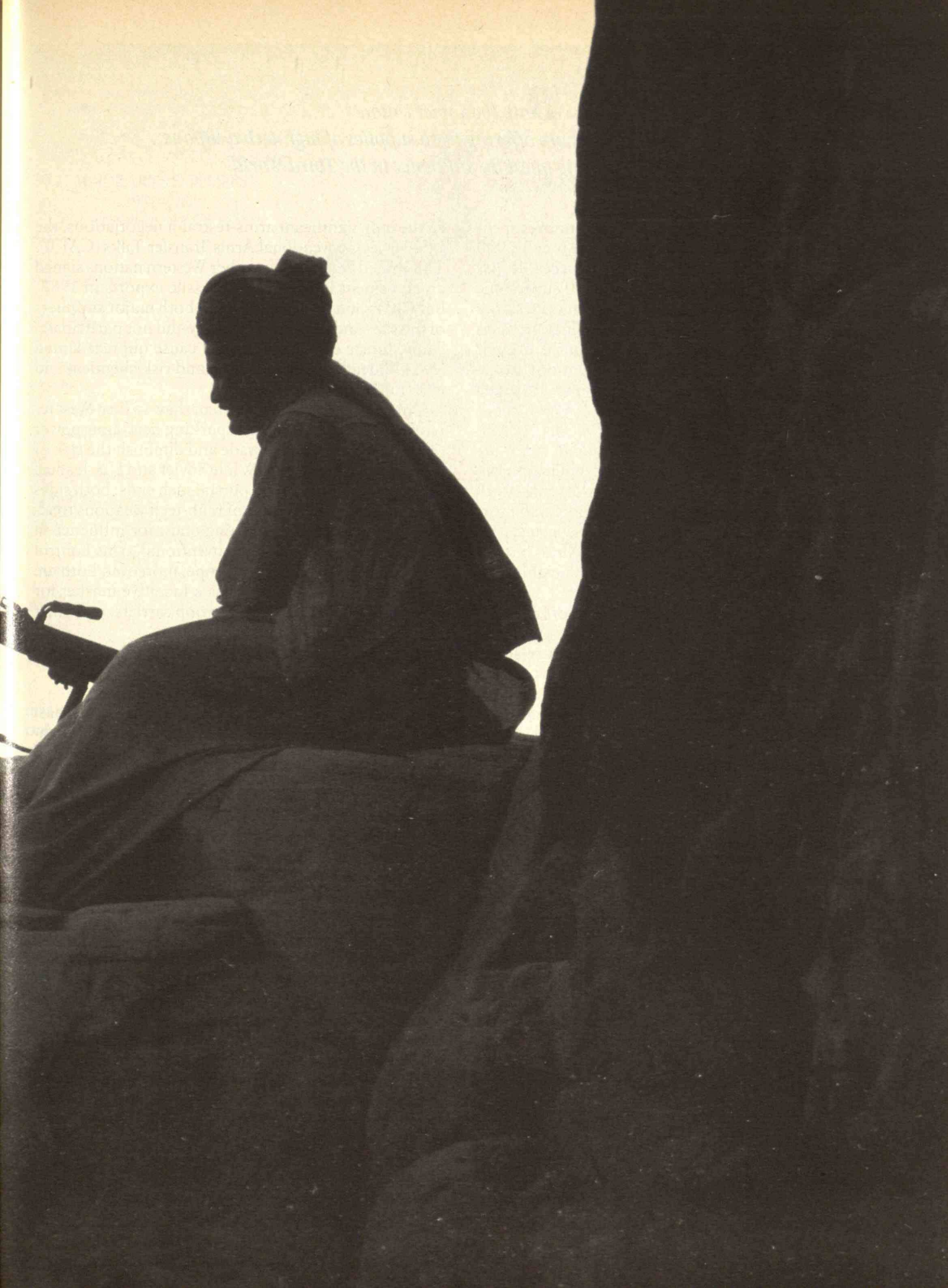
The Arms Trade in the 1990s

BY MICHAEL T. KLARE

THE world is awash in arms. While many are possessed by the superpowers and their closest allies, more than ever before the arsenals of small and medium-sized Third World powers stock modern weapons of all kinds.

REUTERS/BETTMAN
NEWSPHOTO





Both the Soviet Union and the United States are offering fresh supplies of high-tech weapons in a continuing quest for influence in the Third World.

Between 1981 and 1988, developing countries spent \$345.6 billion (in 1988 dollars) to acquire over 37,000 surface-to-air missiles, 20,000 artillery pieces, 11,000 tanks and self-propelled howitzers, 3,100 supersonic fighter planes, and 540 warships and submarines. Iran and Iraq used chemical weapons and ballistic missiles with terrifying abandon in the final months of their eight-year war. And many Third World nations are acquiring the technology to produce their own advanced munitions.

Fortunately, the Persian Gulf conflict and several other regional struggles have been suspended, but the world is still torn by numerous wars and ethnic embroilments, and the prospect is for more of the same. With the erosion of superpower hegemony, more and more nations and partisans are employing sophisticated arms to gain or regain long-sought territories, redress historic grievances, and assert dominion over neighboring lands.

Prospective belligerents in these endeavors can turn to a wide variety of sources to obtain the weapons they need. Third World powers that enjoy friendly relations with Washington, Moscow, Paris, or London can purchase almost any item on the international market (if, of course, they can come up with the necessary cash or credit). Countries such as Libya and South Africa can look to the black market or the growing number of Third World producers, most of which place few, if any, restrictions on their arms exports. Together these overt and covert channels provide about \$40 billion to \$50 billion worth of arms and military hardware to Third World forces every year.

Although most of the 30 wars now under way around the world stem from long-simmering local disputes, these uncontrolled arms sales have hastened the outbreak of conflicts, contributed to their destructive impact, and enabled belligerents to go on fighting rather than negotiate peace. The risks posed by such regional conflicts are likely to multiply as more Third World countries acquire sophisticated arms and weapons of mass destruction.

Despite this terrifying prospect, the world community has made very little effort to curb the international flow of arms. The result is that virtually any nation with enough funds can acquire mammoth stockpiles of almost any weapon. In 1979, Jimmy Carter suspend-

ed the only significant arms-restraint negotiations, the U.S.-Soviet Conventional Arms Transfer Talks (CATT). The United States and six other Western nations signed an agreement limiting some missile exports in 1987, but China and the Soviet Union, both major suppliers of missiles and missile technology, did not participate. Thus, future engagements may cause unprecedented levels of death and destruction and risk chemical and even nuclear escalation.

Unfortunately, even the current thaw in East-West relations does not seem to be sparking new superpower efforts to curb the arms trade and diminish the risk of regional conflagrations. While Soviet and U.S. leaders have expressed a desire to pursue such ends, both sides are offering fresh supplies of high-tech weapons to allies and clients in a continuing quest for influence in the Third World. With a conventional arms control agreement in the offing in Europe, moreover, both are looking to the Third World as a lucrative market for surplus tanks, artillery pieces, troop carriers, and other such hardware.

What's for Sale

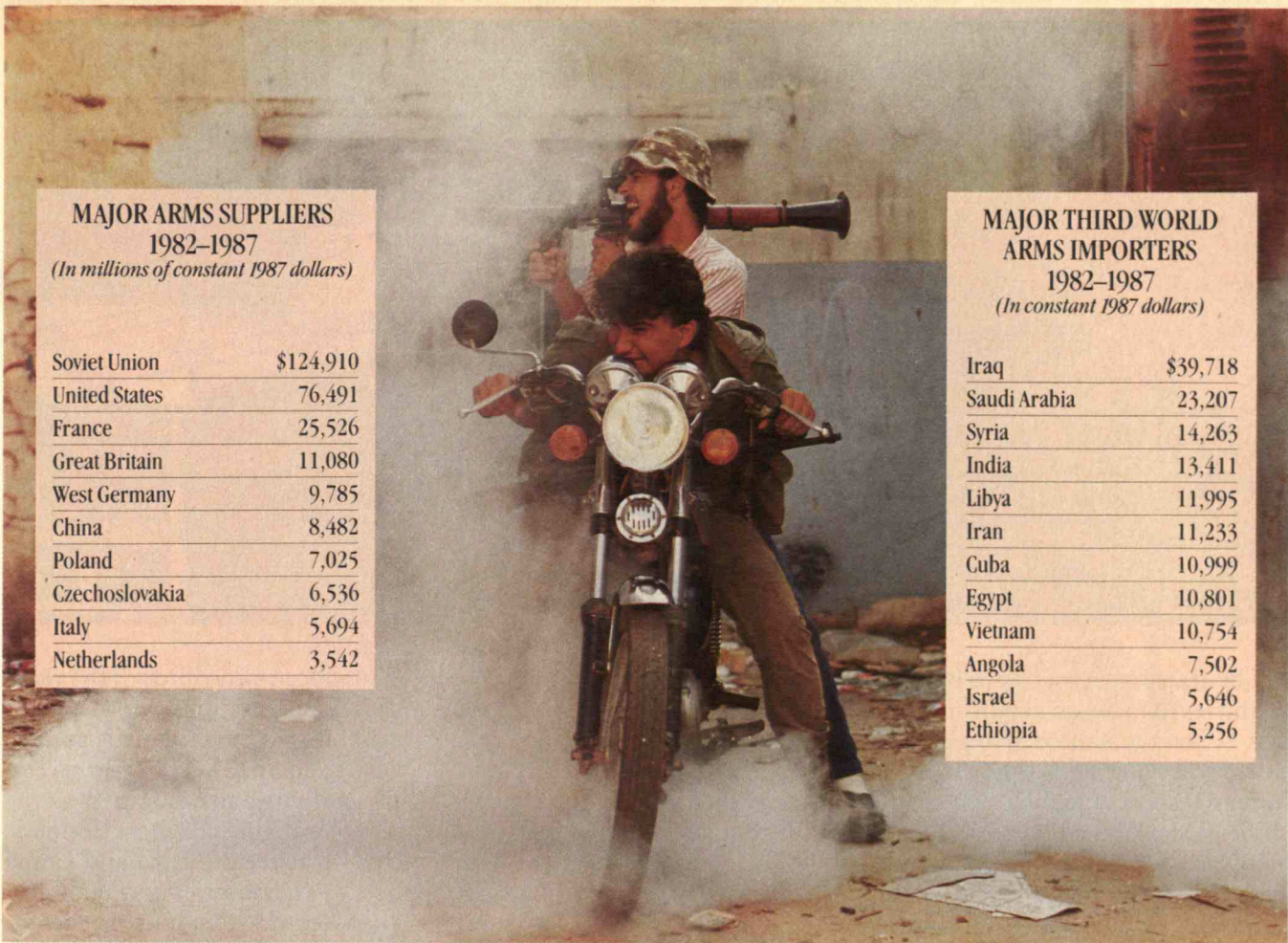
In a rush to modernize their militaries during the past decade, many Third World leaders reached for the high-tech planes, tanks, and warships they assumed would prove decisive in massive air, armor, and sea battles. Between 1980 and 1983 alone, developing countries acquired over 7,800 tanks and self-propelled guns, 2,200 supersonic combat aircraft, 1,300 helicopters, and 80 surface warships. These big-ticket items pushed annual arms sales to unprecedented heights.

But by the middle of the decade, many of the same leaders began rethinking the need for sophisticated front-line systems. Their militaries lacked the skills to use and repair the complicated weapons they had ordered. And spiraling debt and the plummeting price of oil began forcing prospective buyers to forego new systems and instead acquire "upgrade kits"—advanced electronics, guns, and fire-control systems for older-model tanks, aircraft, and warships.

Many nations also looked to the Iran-Iraq conflict, which had evolved into a prolonged war of endurance in which the quantity of arms on each side—not their quality—often made the difference. Iran and Iraq each spent billions of dollars on low-tech artillery and hardware; other countries, fearful of being caught in the same situation, have made similar purchases.

To counter the growing incidence of ethnic conflict

MICHAEL T. KLARE, an associate professor at Hampshire College, directs the Five-College Program in Peace and World Security Studies. He is the author of *American Arms Supermarket* (University of Texas Press, 1985) and co-editor of *Low-Intensity Warfare* (Pantheon, 1988).



MAJOR ARMS SUPPLIERS

1982-1987

(In millions of constant 1987 dollars)

Soviet Union	\$124,910
United States	76,491
France	25,526
Great Britain	11,080
West Germany	9,785
China	8,482
Poland	7,025
Czechoslovakia	6,536
Italy	5,694
Netherlands	3,542

MAJOR THIRD WORLD

ARMS IMPORTERS

1982-1987

(In constant 1987 dollars)

Iraq	\$39,718
Saudi Arabia	23,207
Syria	14,263
India	13,411
Libya	11,995
Iran	11,233
Cuba	10,999
Egypt	10,801
Vietnam	10,754
Angola	7,502
Israel	5,646
Ethiopia	5,256

and guerrilla insurgency, Third World nations have also ordered vast quantities of small arms, infantry weapons, off-road vehicles, and police hardware. These "low-intensity" wars rarely produce major battles of the sort witnessed in the Persian Gulf, but they have nevertheless killed hundreds of thousands—perhaps millions—of people in Latin America, Southeast Asia, sub-Saharan Africa, Lebanon, Afghanistan, and the Philippines. Continuing economic problems will only worsen the social tensions that give rise to such conflicts in the coming decade.

But even while the allure of most front-line systems has diminished, many Third World countries have kept their sights on acquiring modern missiles. The sinking of the British *Sheffield* by an Exocet missile in the Falklands War revealed the lethal effectiveness of precision-guided anti-ship missiles. In Afghanistan, shoulder-fired Stinger anti-aircraft missiles dramatically improved the military fortunes of the anti-Soviet mujahedeen almost overnight. And Iran and Iraq used much larger (if somewhat less accurate) ballistic missiles to punish each others' civilian populations during the "war of the cities." While not as devastating as the massive tank and artillery battles at the front lines, these attacks leveled residential blocks and killed many non-combatants.

Until 1982, the Soviet Union and the United States accounted for two-thirds of the world's weapon sales. But more nations are now cashing in on the business, including China, Brazil (not shown), and a host of others. The new Third World producers offer reliable, no-nonsense weapons at affordable prices.

All the major arms recipients have either engaged in armed combat within the past decade, run a regional

arms race, or both. Most of these arms consumers have large oil supplies or military subsidies from one of the superpowers. The emerging Pacific Rim powers are expected to be major buyers in the coming decade, as are countries facing insurgent or ethnic conflicts.

Photo: Sbi'ite militia fire rocket-propelled grenades on Palestinian positions in Lebanon.

Below: Arms exporters advertise their wares.



The Iran-Iraq experience has also led Third World countries to focus on acquiring arms-making technology. When the United States organized a global arms embargo against Iran—known as Operation Staunch—Iranian leaders launched a crash program to set up facilities for producing a wide variety of basic combat hardware. South Korea, Taiwan, Egypt, India, Pakistan, and Turkey have followed suit, sometimes cutting back purchases of finished weapons to conserve funds for machine tools, electronics, and other specialized imports. For example, Turkey plans to invest most of its \$10 billion military-hardware budget in technology for making clones of the U.S. F-16 fighter, Stinger missile, and Multiple Launch Rocket System. Both South Korea and Taiwan intend to use U.S. parts and technology to manufacture modern jet aircraft, while India will produce the Soviet MiG-27 aircraft and T-72 tank.

Many nations have launched programs to develop and produce ballistic missiles. According to the Stockholm International Peace Research Institute (SIPRI), this roster includes Argentina, Brazil, Egypt, Iran, Iraq, Israel, India, Pakistan, South Korea, and Taiwan. Some of these countries, again influenced by the example of Iran and Iraq, will probably seek the materials and technology to produce chemical munitions. And by the end of the decade, several more Third World nations are likely to join China, Israel, India, Pakistan, and South Africa in developing their own nuclear weapons.

Who's Selling

An exclusive club of nations supplied these arms to the global market—until recently. From 1975 to 1982, six nations—the United States, the Soviet Union, Great Britain, France, West Germany, and Italy—sold 84 percent of all munitions ordered by Third World countries. The two superpowers enjoyed an especially privileged

position, accounting for about two-thirds of the value of military sales to developing nations.

However, as the 1980s progressed, Belgium, Czechoslovakia, Holland, Poland, Spain, Sweden, and several Third World nations eagerly began cashing in on the booming arms business. Probably the most dramatic development was the emergence of Brazil and China as world-class suppliers. Both countries now manufacture a wide range of basic combat equipment, including light and heavy armored vehicles, rockets and missiles, trucks and jeeps, and light combat aircraft. Israel, North Korea, South Korea, and Egypt also posted significant export gains in the 1980s. All the new producers offer reliable, no-nonsense weapons at prices way below those charged by traditional suppliers. And, unlike the usual sellers, the newcomers rarely look for political favors from recipients, such as access to military bases or support for covert paramilitary activities.

The global arms picture is likely to broaden even more in the coming decade as still other producers seek to carve out a market niche. India, Indonesia, Pakistan, Singapore, Taiwan, and Turkey have all announced plans to become major exporters. Small and medium-sized European producers are joining forces with multinational firms to compete with the United States and the USSR in developing costly high-performance systems. An example is the Eurofighter consortium, consisting of firms in Italy, Spain, West Germany, and Britain. Cooperation between Third World producers is also growing. Argentina, for instance, collaborated with Egypt and Iraq in developing the Condor II ballistic missile.

The stiff competition among these suppliers means that fewer are willing to cut off sales to areas of conflict or to governments charged with human-rights violations and terrorism. West Germany and Sweden, for example have gradually relaxed their constraints or



Left: An Iranian oil platform blazes after an attack by U.S. warships in the Persian Gulf in 1988. Conflicts between heavily armed Third World nations can escalate to superpower involvement. Above: Salvadoran government troops ride artillery equipped with anti-aircraft guns to meet guerrillas (right) armed with heavy U.S.-made M-60 machine guns. Belligerents worldwide have access to virtually any weapon they want.





chosen to overlook them. (West German companies have been charged with selling chemical-weapons technology to Libya and submarine technology to South Africa.) And France, West Germany, and Italy ignored Operation Staunch and supplied the Persian Gulf conflict.

Exporters are also willing to sell arms of ever-greater sophistication. This trend is especially evident in the case of the two superpowers, which used to be reluctant to sell their most advanced systems to Third World clients. For example, the United States has sold AWACS (airborne warning and control system) aircraft to Saudi Arabia, while the Soviets have sold MiG-29 aircraft and SS-21 surface-to-surface missiles to Syria and leased a nuclear-powered submarine to India.

Besides supplying sophisticated weapons, both superpowers and their allies are providing favored clients with the technology for making arms. The United States has not only sold South Korea and Turkey the means of producing fighter aircraft, but has also sold Egypt blueprints and equipment for making M-1 tanks. The Soviets have furnished India with technology for manufacturing T-72 tanks and the MiG-27 aircraft, and West Germany is helping Brazil, India, and South Korea build modern diesel-powered submarines.

Who's Buying

Although these developments are leading growing numbers of Third World countries to make at least some weapons, most nations still rely on the international market for a significant share of their military requirements. According to the U.S. Arms Control and Disarmament Agency, some 107 Third World countries each imported at least \$1 million worth of arms between 1983 and 1987.

Within this group, a relatively small number of countries have accounted for a large percentage of the total arms imports. The major recipients have either engaged in armed combat within the past decade (Angola, Cuba, Ethiopia, Iran, Iraq, Israel, Libya, Syria, Vietnam), run a regional arms race with a neighboring rival (India vs. Pakistan; India vs. China; Israel vs. Egypt, Iraq, Syria, and Saudi Arabia; Egypt vs. Libya), or both. Most of these nations could afford these purchases because they possess large supplies of petroleum or receive substantial military subsidies from one of the superpowers.

These 12 countries will probably remain high on the list of the world's top arms buyers in the coming decade. (Their ranking may change if the Soviet Union

The superpowers and their allies are providing favored clients with the technology for making arms. The United States has sold Turkey the

means of producing the F-16 (below). Turkey is also cloning the U.S. Stinger anti-aircraft missile, a popular item worldwide

(left). Many developing nations are designing and selling their own sophisticated weapons. Bottom: Brazil's Urutu armored personnel carrier.



saves money by cutting back on military assistance to Cuba, Ethiopia, and Vietnam and the United States does the same to Egypt, Israel, and Turkey.) Meanwhile, the emerging economic powers of the Pacific Rim, including South Korea, Taiwan, Malaysia, and Singapore, are boosting their spending on imported arms and military technology. South Korea, for instance, increased its military outlays from \$2.9 billion in 1980 to \$5.3 billion in 1986, while Taiwan's spending has soared from \$2.8 billion to \$6.2 billion. The United States has encouraged these countries to spend more on their own defense as budget problems at home have worsened. Third World countries facing major insurgent or ethnic conflicts—including Angola, Afghanistan, El Salvador, Peru, and the Philippines—will also be major buyers, often with funds provided by the big powers.

The Results

The virtually unlimited diffusion of war-making materiel is accelerating the tempo of global violence. The number of major conflicts under way in any given year has risen steadily over the past few decades, and these conflicts seem to be lasting longer. Furthermore, in all three of the major wars of the 1980s—the Falk-

lands conflict, the 1982 Israeli-Syrian encounter in Lebanon, and the Iran-Iraq contest—the initial protagonists (Argentina, Israel, and Iraq) had built up large stockpiles of military supplies and apparently assumed that such provisioning would ensure their success.

Once armed combat erupts, the easy availability of weapons allows belligerents to conduct wars of great magnitude and scope. The Iran-Iraq war lasted eight years, consumed \$55 billion worth of imported arms and ammunition, and injured or killed about 1,250,000 people. Some 41 countries sold arms or ammunition to at least one side—and 28 supplied military hardware to both.

The fighting in Afghanistan killed as many as 500,000 people over 10 years and left 6 million refugees. Bomb and rocket attacks virtually annihilated many provincial towns and villages. In Lebanon, heavily armed militias and sectarian armies cause thousands of casualties each year in a seemingly endless fratricidal conflict. And in El Salvador, where both sides appear to have access to an unlimited supply of modern arms, the death toll, mostly civilians, has now reached 70,000.

Besides lengthening regional wars, arms transfers have also escalated them, as the Persian Gulf conflict graphically showed. After countless battles failed to yield a clearcut victory for either side, both Iran and Iraq struck at ships and oil facilities located far from the front lines of battle, often hitting vessels that belonged to officially neutral countries. And both sides rained ballistic missiles and chemical weapons on opposing populations.

Fortunately, neither country placed chemical warheads on ballistic missiles—a fateful step that could have killed thousands more civilians. But several Middle Eastern countries are capable of doing so. Syria, for instance, has reportedly developed chemical warheads for its Soviet-supplied Scud-Bs and SS-21s.

Hybrid weapons of this sort clearly pose a significant threat to regional stability. Israeli leaders have threatened to attack Syria if they have any reason to believe that Damascus is readying a chemically armed attack. And if Syria were to launch such an assault, Israel could retaliate with its nuclear weapons.

Indeed, the proliferation of nuclear weapons, chemical munitions, and high-tech conventional arms is creating a number of incipient Third World "superpowers" capable of conducting military operations on a scale previously reserved for the United States, the Soviet Union, and their closest industrial allies. At this point, only China, Israel, and India can claim this dubious

*As long as the United States
and the Soviet Union continue to expand their arsenals, they can't enjoin emerging
Third World powers from doing likewise.*

status, but by the end of this decade, a major conflict involving Brazil, Iraq, Pakistan, South Africa, South Korea, Taiwan, or Turkey would risk significant, and possibly nuclear, escalation. Because such conflicts could jeopardize the interests of the superpowers, future wars of this type are the most plausible spark for World War III.

What to Do

What can the world community do to reduce the risks posed by the uncontrolled international arms trade?

Clearly, arms curbs alone cannot work, since warfare is the product of acute, long-standing political and ideological conflicts. Preventing further bloodshed in the Third World will require investigating the causes of these conflicts and alleviating the grievances and suspicions that give rise to war. This task is best pursued under the auspices of the United Nations or through regional entities such as the Contadora Group in Central America. The United States can facilitate this process by supporting regional peace initiatives, acting as a third-party mediator (as in the settlement on the Namibian conflict), and supplying troops and funding for U.N. peacekeeping operations.

Furthermore, arms control in the South must proceed arm in arm with arms control in the North. As long as the United States and the Soviet Union continue to expand their arsenals, they can't enjoin emerging Third World powers from doing likewise. With the signing of a START treaty and an agreement on conventional arms control in Europe, leaders of developed countries will be in a much stronger position to convince their Third World counterparts of the need to adopt similar constraints.

Preventing further spread of the materials and technology for making nuclear and chemical weapons should take priority. The Nuclear Non-Proliferation Treaty (NPT), signed in 1968, must be made more effective by tightening restraints on diverting nuclear-power materials and technology to weapons programs. No similar ban exists on the spread of chemical weapons, but a Chemical Weapons Convention has been under negotiation in Geneva since 1980 and is reportedly nearing completion.

The next priority should be controlling the spread of ballistic missiles that can be used to deliver chemical and nuclear warheads. The only curb on these systems, the Missile Technology Control Regime (MTCR), was signed in 1987 by the United States, Canada, Bri-

tain, France, Italy, Japan, and West Germany. While a useful first step—the MTCR sets voluntary constraints on the export of missile parts and technologies—the agreement has significant loopholes. For example, it allows for export of rockets used for space research, which can be converted to military use. And exporters of missile technology such as Brazil, China, and the Soviet Union have not signed the document. Closing the loopholes in this treaty and including more countries should be a major priority for the 1990s.

Once these efforts are under way, attention can turn to reducing the arms trade proper. One way to begin is to resume the U.S.-Soviet Conventional Arms Transfer Talks (CATT), suspended in 1979. While no treaty documents were ever produced, CATT negotiators reportedly reached agreement on many basic elements of scope and nomenclature. Resuming the CATT talks would send a powerful signal that the world's leading arms suppliers are serious about curtailing their sales.

Truly controlling the weapons trade will require involving other major suppliers—especially France, Britain, West Germany, and China—in an expanded CATT process. The United States and the Soviet Union could start this process by adopting bilateral measures such as an annual ceiling on arms transfers to Third World countries, and then invite the other major suppliers to participate. That way the superpowers could first master the complex problems of verification that such agreements would entail.

Finally, the United States and the Soviet Union should convene negotiations between themselves and pairs of superpower-aided rivals, such as North and South Korea, to reduce arms transfers. The same formula could be tried with India and Pakistan, and Israel and Syria. While these countries have resisted such negotiations before, they might find mutual arms limits useful if the superpowers agreed to help prevent aggressive action by their clients. Obviously, it would be ideal if such agreements could be forged in the context of a regional peace settlement.

No one measure can eliminate the violence now overwhelming the international community. If the world is truly to protect itself from the dangers of regional conflicts, it needs to adopt a comprehensive system of security that links arms control with improved methods of international mediation, crisis control, and peacekeeping. Still, a concerted effort to curtail the world arms trade, particularly in destabilizing weapons, could help lower the risk of war and prevent the escalation of conflicts that do occur. ■

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Beyond the Montreal Protocol

Still Working on the Ozone Hole

IN June, environmental officials from around the world will meet in London to determine what further steps to take to protect the stratospheric ozone layer. The London meeting will allow the more than 50 nations ratifying the 1987 Montreal Protocol, which mandated substantial cuts in the use of chemicals that can damage the earth's protective ozone layer, to make the first changes since the protocol went into force in January 1989. The changes are likely to be significant.

Until recently, debate on chlorine, the most important element that catalyzes destruction of stratospheric ozone, focused almost exclusively on chlorofluorocarbons (CFCs). These compounds are used in refrigeration and air-conditioning, as aerosol propellants and solvents, and to form foams, including those used in fast-food packaging and as rigid insulation. The Montreal agreement requires industrialized countries to halve their use of five CFCs by 1998

and to freeze their use of three halons, chemicals used in firefighting that contain ozone-depleting bromine.

However, the protocol makes no mention of two other ozone-depleting compounds: methyl chloroform, one of the most widely used organic solvents, and carbon tetrachloride, perhaps the cheapest and most toxic organic solvent. Carbon tetrachloride is pound for pound more ozone-depleting than any of the five

regulated CFCs, and both it and methyl chloroform contribute more to ozone-threatening chlorine levels than all but two of the eight regulated CFCs and halons.

Emissions from all these compounds make human industrial activity the overwhelming source of stratospheric chlorine. Chlorine releases from the oceans, large volcanic eruptions, and biomass burning, including fuel wood as well as natural and anthropogenic forest fires, create an average level of .7 part per billion by volume (ppbv) in the stratosphere. Chlorine

BY ARJUN MAKHIJANI, AMANDA BICKEL, AND ANNIE MAKHIJANI

*The Montreal agreement
has spurred cuts in the use of ozone-depleting CFCs.
But signatories soon must decide whether to include
more compounds and how to increase
Third World participation.*

emissions from industrially produced chemicals add about four times that amount.

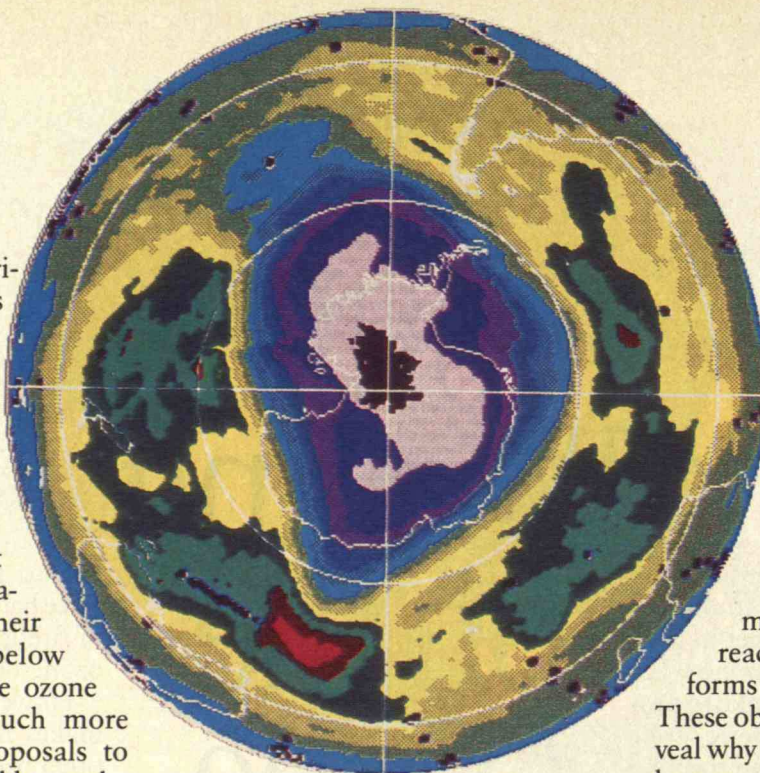
The Montreal Protocol and legislation in some countries have made inroads on reducing these anthropogenic emissions. But to get chlorine concentrations anywhere near their natural levels—and below those that threaten the ozone layer—will require much more stringent controls. Proposals to enact such controls will be on the table in London.

The parties will also begin considering limits on HCFCs, newly created CFC substitutes that themselves damage the ozone layer. And the signatories will have to confront the lack of broad participation by Third World countries, which threatens progress on all fronts. Even a phaseout of the use of methyl chloroform and carbon tetrachloride, a complete CFC and halon phaseout by 2000, and regulation of HCFCs will not be enough to stop ozone destruction if large Third World countries such as China and India do not join the agreement.

Convincing Evidence Appears

Recent results from ongoing studies of the stratosphere lend urgency to the June meeting.

The 1985 report by the British Antarctic Survey—which helped propel the protocol forward—showed that massive ozone depletion occurs over the Antarctic each spring. However, the report never formally recognized the relationship between the huge seasonal depletion and the use of CFCs. This link came into sharper focus soon after the protocol was signed in September 1987. The second American National Ozone



Measurements by NASA's Nimbus-7 satellite in October 1989 reveal an ozone hole (lighter colors) 80 percent larger than Antarctica. Ozone loss is also occurring over middle latitudes.

Expedition (NOZE II) and the international Airborne Antarctic Ozone Experiment, which sent planes into the ozone hole that October, found strong correlations between levels of chlorine monoxide and ozone depletion. (Chlorine monoxide, a chemical that reacts readily with ozone, forms when CFCs disintegrate.)

These observations also helped reveal why high chlorine levels might become especially damaging over the Arctic and Antarctic: ice particles in stratospheric clouds provide surfaces on which longer-lived chlorine molecules are converted into forms like chlorine monoxide.

The ice particles can also "lock up" forms of nitrogen that would normally react with chlorine to form more stable compounds.

Then in March 1988, the prestigious Ozone Trends Panel released an analysis showing that ozone loss was considerably greater over middle latitudes than computer models had predicted. The panel concluded that from 1969 to 1986, ozone levels had dropped 1.7 to 3 percent in the latitude band 30° to 64° N, which covers most of the United States, Europe, the Soviet Union, and China. Wintertime depletion in the northern portion of this region was even more severe: 5 to 6 percent.

These decreases mean that ever higher levels of dangerous ultraviolet light are probably penetrating to the earth's surface. According to the U.N. Environment Programme, every 1 percent drop in ozone levels will lead to a 3 percent increase in non-melanoma skin cancers in light-skinned people, as well as dramatic increases in cataracts, lethal melanoma cancers, and damage to the human immune system. Higher levels of ultraviolet light may also worsen ground-level pollution and hurt plants, animals, and ecosystems, especially light-sensitive single-celled aquatic organisms.

Although recent findings provide conclusive evidence that human activities have been damaging the ozone layer, the political situation, as much as the scientific evidence, has changed significantly since 1987. Inter-

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*Even if CFCs are completely phased out,
levels of ozone-depleting chlorine could double, triple,
or even quadruple.*

national opinion was divided only three years ago, making even modest reductions in CFC production and use difficult to attain. Most CFC producers, who had been fighting any kind of controls since the 1970s, argued that scientific evidence was too inconclusive to warrant regulation, although some were willing to support limited international regulation. These producers had only recently resumed testing of alternative chemicals, having drastically cut back on research in the early 1980s.

The outlook changed in March 1988 when DuPont, the largest producer of CFCs, reversed its position and said it would phase out its production. (It has now said this will occur by the year 2000.) Although not all corporations have agreed to change as readily as DuPont, the trend is in that direction. Both producers and users have adjusted to the idea that CFCs are not likely to be on the market much longer.

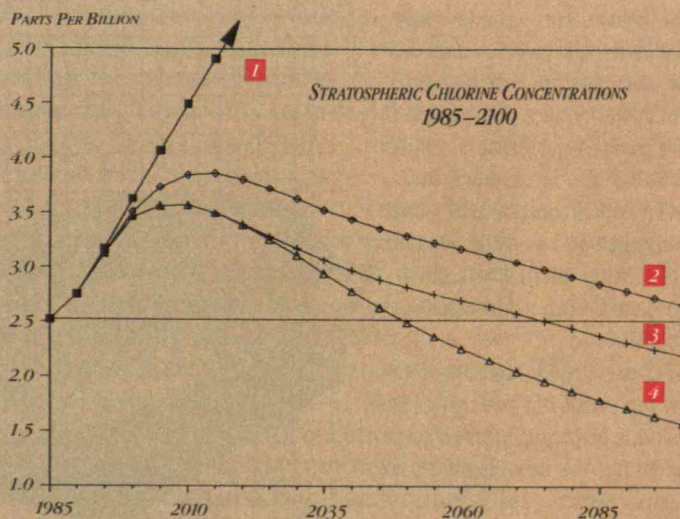
In March 1989, the European Economic Community announced support for a complete phaseout of CFCs by 2000. President Bush also announced support for a 2000 phaseout, contingent on the availability of substitutes. A phaseout will probably become a binding amendment to the protocol this year, though there may be some controversy over the schedule for intermediate cutbacks. Participants in a preliminary meeting in Helsinki last year also supported an undeter-

mined date for a halon phaseout, and a cutback in other unspecified substances that deplete ozone.

These "other" substances have been much slower to receive high-profile attention than CFCs. This is largely because no one had systematically reviewed compounds such as methyl chloroform and carbon tetrachloride before the Montreal Protocol, although some evidence that they cause damage was available. Not till many months after the Ozone Trends Panel announcement did the U.S. EPA and some environmental groups show that chlorine levels could double, triple, or even quadruple because of these chemicals, even if CFCs were completely phased out. Models now reveal that overall chlorine concentrations could expand from around 3 parts per billion by volume (ppbv) in 1985 to around 12 ppbv in 2100 under the protocol's current limits.

Of course, actual stratospheric loading and ozone destruction could be less—or more. Other changes in the atmosphere, including global warming, may have unpredictable effects on the stratosphere. For example, the stratosphere could cool as greenhouse gases trap heat near the earth's surface. Or sulfuric-acid aerosols from industrial pollution and volcanos could act like the icy particles in polar clouds, speeding up ozone loss at middle latitudes.

To allow any significant increase in ozone-depleting



- 1 Montreal Protocol reductions; no carbon tetrachloride or methyl chloroform controls
- 2 CFC and carbon tetrachloride global phaseout in the year 2000; methyl chloroform freeze in 1991
- 3 CFC, carbon tetrachloride, and methyl chloroform global phaseout in 2000
- 4 CFC, carbon tetrachloride, and methyl chloroform global phaseout in 2000; HCFC global freeze in 2015, phaseout in 2030

Even with the cuts in CFC use that the Montreal Protocol calls for, levels of ozone-depleting chlorine in the stratosphere will skyrocket. Phasing out methyl chloroform, another chlorine source, would bring levels down quickly because it decays faster than CFCs. Carbon tetrachloride, a chlorine-based solvent that is more ozone depleting than any CFC, will have to be controlled. And HCFCs, which are new substitutes for CFCs, also deplete ozone and contribute to global warming and should eventually be phased out. The chart assumes that HCFCs will capture 30 percent of the CFC market, and that all countries will participate in cutbacks.

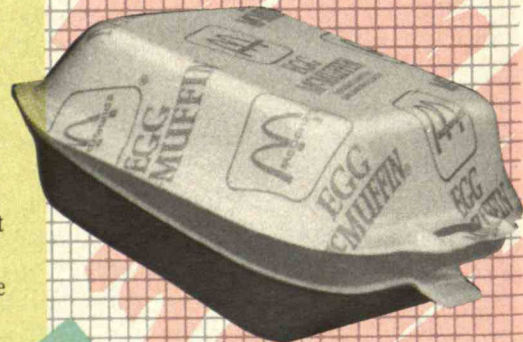
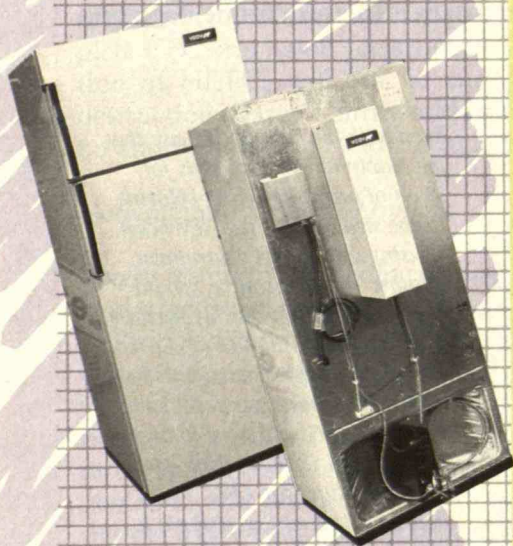
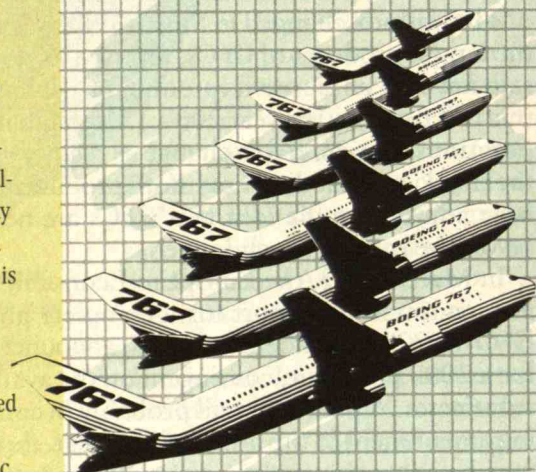
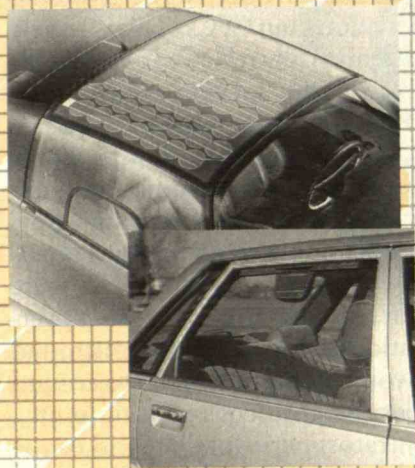
Progress on CFC Substitutes

WITHIN a few years, auto companies expect to market air conditioners based on HFC 134-A, an alternative to the CFCs now used. HFCs do not contain chlorine and thus do not break down the ozone layer. But they do contribute to global warming, so solar air conditioning may be a safer long-term alternative. Left: A rooftop solar array developed by Saab-Scania powers a fan that ventilates the car while it is at rest. A window solar collector, created by Solar Electric, performs the same job.

Methyl chloroform is widely used as a solvent to clean metal—including airplanes—and electronic equipment. Although methyl chloroform damages the ozone layer, phasing it out should be relatively easy: alternatives are available for 90 percent of its uses. For example, soapy water can be used to clean aircraft.

Manufacturers are looking hard at new HCFCs to replace CFCs as compressor gases in refrigerators. But because HCFCs also break down the ozone layer and contribute to global warming, helium-based refrigeration may be a better alternative. Left: Cryodynamics Corp. is developing one model.

HCFCs are already replacing CFCs in blowing styrofoam packaging. But other forms of packaging may have to be found if the new chemicals are themselves phased out.



*A phaseout of
methyl chloroform would cut chlorine levels rapidly
and dramatically in a way that a
CFC ban cannot match.*

chlorine, much less a rise to 12 ppbv, is to court catastrophe. The sudden occurrence of the Antarctic ozone hole in the late 1970s, as well as the unexpected effects over mid-latitudes, show that growing chlorine concentrations are producing effects much greater than scientists believed only a few years ago.

Dealing with Methyl Chloroform

If CFCs are phased out, methyl chloroform will be the single greatest source of ozone-depleting chlorine emissions. Industry uses this solvent—1,1,1 Trichloroethane, or TCA—extensively to clean metal. It is also used in aerosols, coatings, and adhesives, as well as in cleaning electronic equipment. Molecule for molecule, methyl chloroform is not as ozone depleting as the five regulated CFCs, since most of it degrades in the lower atmosphere. Its punch is only about 15 percent that of CFC-11, one of the two most widely used CFCs, for example. But methyl chloroform emissions pose a serious threat to the ozone layer because industries use almost as much of it as all the CFCs combined.

EPA figures show that this compound accounts for about 15 percent of today's atmospheric chlorine buildup—almost four times more than CFC-113, the primary CFC solvent. Although methyl chloroform emissions have stabilized in the United States, regulation of other chlorinated solvents could boost releases once again. Besides cutting back the use of CFC-113, EPA is restricting the use of volatile organic solvents (VOCs) because they contribute to ground-level pollution. EPA has also lowered exposure limits for perchloroethylene and trichloroethylene, which could substitute for CFC-113 if they weren't so toxic. These changes could lead to significant increases in methyl chloroform's contribution to stratospheric chlorine.

A phaseout of methyl chloroform, in contrast, would cut chlorine levels rapidly and dramatically in a way that a CFC ban cannot match. That's because the former has a half-life of 6 years, while CFC-11 and CFC-12, the longest-lived CFCs, have half-lives of about 60 years and 120 years, respectively. If methyl chloroform emissions are not halted, declines in ozone destruction will be much slower, since the CFCs and halons already released will continue to cause damage for decades.

Fortunately, phasing out methyl chloroform should be relatively easy. Replacements are available for 90 to 95 percent of the chemical's uses, according to a recent evaluation prepared for the U.N. Environment

Programme. Several corporations, including General Dynamics, have already eliminated it or are in the process of doing so. And, as is true of CFC-113, most of the alternatives, such as water-based cleaning, are less damaging to the environment. (In water-based cleaning, slightly acidic or alkaline soapy water is sprayed onto a surface. The wastewater can be recycled.) Until recently, however, most businesses were not aware of the threat that methyl chloroform poses to the ozone layer, and many were in fact planning to substitute it for CFC-113. With better information and stricter controls, the transition from both CFC-113 and methyl chloroform to alternatives could proceed rapidly.

Cutting Carbon Tetrachloride

The potential for phasing out most uses of carbon tetrachloride is also good, and there are similarly compelling reasons to do so. Carbon tetrachloride is used as a solvent in a range of common metal-cleaning applications, and in manufacturing CFCs. The 1987 protocol overlooked this chemical despite the fact that it, like the more well-known CFCs, does not break down in the lower atmosphere. Pound for pound, it is 10 to 20 percent more ozone-depleting than CFC-11, the most potent of the CFCs.

Since carbon tetrachloride is highly toxic, the United States and many other Western countries have largely restricted its use to the manufacture of CFCs. But Eastern Europe, the Soviet Union, and the Third World still use carbon tetrachloride as a solvent in considerable quantities. It is not uncommon in some parts of the Third World to see auto mechanics dipping parts into open vats of carbon tetrachloride with their bare hands.

Carbon tetrachloride is attractive to Third World countries because it is much cheaper—costing around 25 cents per pound—than many other chemicals, including CFC-113, which costs around \$1 per pound. The Third World's tendency to use carbon tetrachloride could be even greater when the alternative is no longer CFC-113 but hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs), replacements for CFCs that will probably cost several times as much as carbon tet. And if a revised Montreal Protocol does not cover that compound, production capacity idled by a CFC phaseout in industrialized countries could be redirected to provide solvents to the Third World.



Growing use of carbon tetrachloride in developing nations would lead not only to significant increases in ozone-depleting emissions but would also contribute to severe worker health problems and water pollution. Since less toxic replacements are available for virtually all solvents, carbon tetrachloride could be confined to use as a feedstock in making some CFC substitutes.

Risky Replacements

The new HCFCs and HFCs created to replace CFCs are more controversial targets for regulation than methyl chloroform or carbon tetrachloride. HFCs do not contain chlorine and thus do not deplete ozone. HCFCs, which contain hydrogen in addition to the chlorine, fluorine, and carbon normally present in CFCs, are much less ozone depleting because they largely break down in the lower atmosphere.

HCFC-22, the only HCFC widely available, is used in some refrigeration systems as well as in aerosols and foam blowing. (It is now the primary gas used to make styrofoam food packaging in the United States.) According to the EPA, HCFC-22 contributes about 4 percent of the chlorine buildup in the stratosphere. But as CFCs are phased out, HCFC-22 and other HCFCs being developed will undoubtedly account for more of the buildup.

Both HCFCs and HFCs pose another problem: they contribute to global warming. Like their relatives the CFCs, HCFCs and HFCs trap infrared radiation refracted from the earth's surface in wavelengths that other atmospheric constituents do not. Although the new chemicals have less of an impact than CFCs because they break down faster, many have global-warming effects as high as one-third—and some as much as two-thirds—that of CFC-11. Since CFCs are expected to contribute from 15 to 25 percent of the greenhouse problem, the possibility that HCFCs and HFCs may take their place is worrisome.

HCFCs and HFCs are unlikely to replace CFCs com-

pletely. In many cases, alternatives such as water-based cleaning will be the best substitutes for CFC solvents. However, HCFC use could also expand into new areas. For example, the United States, Canada, and Sweden have banned most uses of CFCs in aerosol sprays, although those products continue to account for about one-third of CFC use in the rest of the world. The U.S. ban alone has prevented the release of about 1 billion tons of CFCs over the past decade. But the 1977 U.S. legislation mandating this ban does not include HCFCs. If they became the standard propellant in aerosol sprays, HCFCs could constitute the world's single most significant source of ozone-depleting emissions.

In the long run, replacing 30 percent of CFCs with HCFCs could keep stratospheric chlorine levels above those that caused the Antarctic ozone hole—even *with* a ban on CFCs, halons, methyl chloroform, and carbon tetrachloride. And some scientists hypothesize that damage from HCFCs and other chemicals could increase substantially if the atmosphere becomes overburdened with pollutants and loses some of its capacity to cleanse itself.

Some parties at the upcoming London meeting will propose regulating or at least monitoring these compounds. A few participants have suggested phasing them out in 20 to 30 years, while others want to prohibit their use in non-essential areas such as aerosol sprays and foam not used for insulation.

But chemical companies such as DuPont and Allied-Signal are naturally encouraging a transition to the compounds they raced to design when regulation of CFCs became imminent. Some of the largest international producers have forged an unusual collaboration, known as the Program for Alternative Fluorocarbon Toxicity Testing (PAFT), to test the new compounds as quickly as possible. And some industries are counting almost exclusively on them to replace CFCs. For example, auto companies are expecting to market HFC-134a air-conditioners within just a few years, while refrigeration firms are looking hard at various mixtures of

*Poor nations will not
participate in CFC cutbacks unless rich nations
help them develop and use technologies that do not
rely on ozone-depleting compounds.*

HCFCs as compressor-gas substitutes. These chemicals will undoubtedly fill the gap in vital areas where no other substitutes are available. But unfortunately, little research is apparently being done on longer-term options.

Helium refrigeration may be one such option. Although helium is commonly used for very low temperature cooling, it has generally been too expensive for home refrigeration, since critical parts must be machined to within one ten-thousandth of an inch. However, Cryodynamics Corp., a New Jersey-based company, claims to have developed a helium cooling technology suitable for domestic refrigerator and freezer temperatures. A team at Oak Ridge National Laboratory thinks the efficiency of these freezers and refrigerators could be equal to or better than that of the best CFC-based technology within a few years, although some reliability and efficiency questions remain. The potential of the Cryodynamics model is not yet clear, but this kind of system clearly merits further study. A group at Oxford University has apparently run a helium-based cooler at domestic temperatures for 40,000 hours.

Increasing Third World Participation

In many respects, progress on eliminating ozone-depleting chemicals has been phenomenal: science and technology have been on a fast track, and the international policymaking process has encouraged these changes. Yet lack of participation in the Montreal Protocol by many Third World countries promises to be a serious obstacle to cutting stratospheric chlorine. As environmentalists pointed out when the protocol was signed, Third World exemptions mean that real consumption of CFCs will likely drop by only 35 percent, rather than the targeted 50 percent.

The protocol allows participating Third World countries to increase CFC use for 10 years before they, like their industrialized counterparts, must reduce consumption by half. Developing countries can take this temporary exemption as long as per capita use remains no higher than .3 kilogram per year—six times their current levels. But many of the most industrialized Third World countries, including India and China, have chosen not to participate in the protocol at all.

Liu Ming-Pu, the Chinese environment commissioner, pointed out at the 1989 Saving the Ozone Layer conference in Britain that developing countries would suffer unduly from the protocol's restrictions. He said that

China would not participate unless wealthy nations help poorer nations develop and buy new technologies that do not rely on ozone-depleting compounds. Many large Third World countries, including India and China, have been making substantial investments in CFC-based refrigeration, for example—investments that they now stand to lose.

Third World countries are in a difficult position. CFC replacement chemicals are expected to be expensive. A pound of CFC-11 cost about 50 cents in 1987. The projected 1994 price for HFC-134a, a substitute refrigerant, is \$3. And developing and adopting technologies that are less ozone depleting promises to be a major undertaking. Some substitutes may involve equipment that is less energy efficient and less durable.

As China has pointed out, the industrialized countries have been the source of the vast majority of ozone-depleting releases. In fact, OECD and Soviet-bloc countries accounted for more than 85 percent of all CFC emissions in 1985. And these countries will continue to be the main source of releases for at least the next decade.

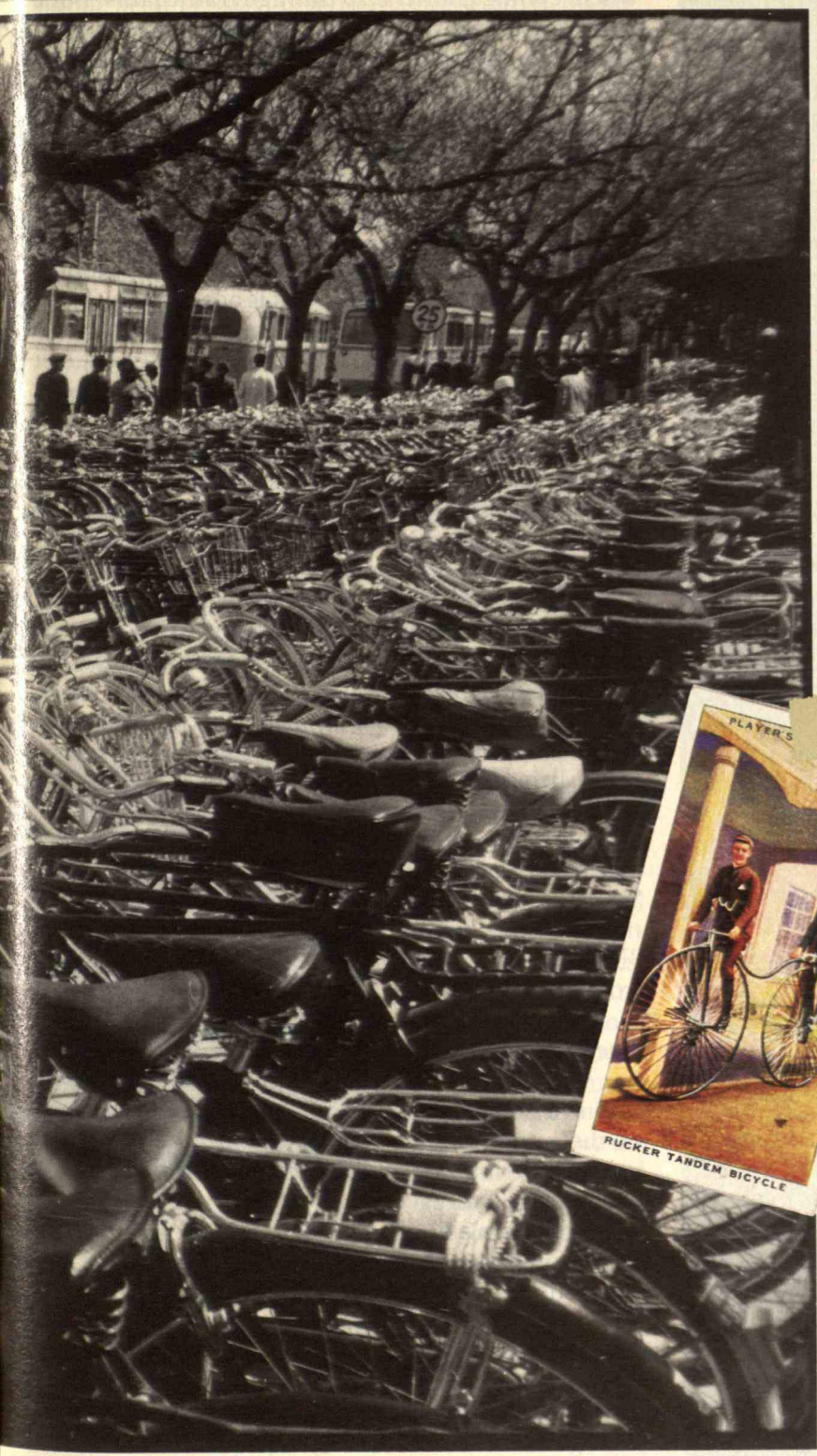
However, failing to obtain broader Third World participation in a stronger protocol would be a mistake. If China and India were to use CFCs at the full .3 kilogram per capita each year, worldwide consumption would rise half again above 1985 levels. If Third World nations consumed at the level of industrialized countries, world use would roughly triple. Such enormous increases would clearly cripple all attempts to limit stratospheric chlorine.

The original protocol, which simply urges technology transfer between rich and poor nations without providing concrete funding, is clearly inadequate. A well-funded research program, perhaps relying on collaboration between scientists from rich and poor countries, could tailor new technologies for Third World use and even foster specialized industries in countries like India and China. The U.N. Environment Programme has begun holding informal discussions with industrialized countries that could provide the needed funding.

We are in the midst of both dangerous pollution of the earth and dramatic efforts to change course. The Montreal Protocol has proven a flexible instrument of international diplomacy. But it needs to be amended, and its international reach broadened. The ability to deal equitably with the needs of the Third World will be a serious test for tackling the far more difficult task of controlling CO₂ emissions and global climate change. Closing the ozone hole is only the beginning. ■



Reinventing



From Denmark to Japan, countries are relying on the bicycle to cut pollution and congestion and save on oil bills.

IN a time so transformed by the automobile that whole landscapes and lifestyles bear its imprint, a significant fact goes unnoticed: a far greater share of personal transport relies on human power. From the 10-speeds of Brooklyn to the black "roadsters" of Beijing, the world's 800 million bicycles outnumber cars two to one—and each year bike production outpaces automobile manufacturing three to one.

Bicycling brings mobility to the remotest villages in developing countries, where people pedal two- and three-wheelers piled high with goods. And bikes are a practical supplement to automobiles in industrial cities,

the Wheels

BY MARCIA D. LOWE

PHOTO: WANG WENLAN



POPULATION PER AUTOMOBILE, 1987

Country	People per Automobile
United States	1.8
France	2.6
Japan	4.1
Venezuela	11.4
Malaysia	12.4
Brazil	15.5
Tanzania	44.9*
South Korea	50.2
Senegal	88.8
Thailand	94.0
Egypt	123.6
Nigeria	141.0
Ghana	217.0
India	544.4
China	1,074.0

*1985

That there are so many people for every automobile in the Third World is not surprising, since cars can cost as much as 30 times the annual per-capita income—or up to 125 times as much as a one-speed bicycle. In China, the population per privately owned automobile was 74,000 in 1988; the number in the table above refers to all cars.



where cycling couriers zip through traffic jams. But a post-war boom in auto use has nearly obscured the utility and ubiquity of the bicycle. Even many developing countries skew transport decisions toward motorized vehicles, although fewer than 1 percent of the Third World population can afford an automobile. Meanwhile, a steady rise in driving in the world's major urban areas is pushing traffic congestion and air pollution to intolerable levels.

The planet needs an alternative to the automobile. Mass transit is one answer, but it is not enough. Third World governments cannot afford adequate mass transit, and residents in industrial countries often reject it because they are accustomed to individual transport.

The bicycle could take on more of the transport burden. Governments can encourage cycling by making auto users bear more of the full costs of driving. And a pro-bicycle stance need not be anti-automobile. The Netherlands, the most bicycle-friendly of all industrial countries, has the Western world's highest densities of both cars and cycleways (separate paths or special bike lanes in roads). In Dutch towns and cities, between 20 and 50 percent of all trips are made by bicycle. Bicycling could be a practical option in many other countries, too. "All you have to do is make it easier to ride a bike than drive a car," says Ellen Fletcher, a town council member of Palo Alto, Calif., one of the United States' most active biking communities. "People will take it from there."

The Price of Driving

Countries that depend on the automobile are paying a terrible price: each year brings a heavy toll from air pollution, oil bills, urban congestion, and road accidents.

Driving motor vehicles creates more air pollution than any other human activity. Gasoline and diesel engines emit a large percentage of the carbon monoxide, hydrocarbons, and nitrogen oxides that result from fossil fuel combustion worldwide. These and other pollutants from automobiles cause ills ranging from destruction of aquatic life in lakes and streams to lung disorders in people. On particularly hazy days in the world's worst smog-filled cities—Mexico City, Athens, Budapest, and many others—officials call temporary driving bans to avert



The smog in urban areas such as Mexico City can be a health threat, aggravating lung disorders and proving deadly to children, the elderly, and fetuses.

public health crises. As serious as these problems are, they pale in comparison to the disruptions that global warming partly stemming from vehicle emissions could inflict on the biosphere.

Motorization also deepens oil dependence, which drains national economies. In the United States, oil imports cost more than 20 percent of the country's foreign trade deficit in 1988. And excluding China, in 1985 low-income developing countries spent on average a third of the money earned through exports on energy imports. Another oil crisis, which some experts believe looms in the future, would make things much worse.

Moreover, automobile congestion is a serious problem in many cities, with average road speeds during peak times often slowing to 5 miles per hour. This situation has forced some police units in European and North American cities—including London, Los Angeles, and Victoria—to use bicycles for patrolling gridlocked urban centers. The Confederation of British Industry warns that traffic congestion already costs Britain \$24 billion a year—including employee time lost through tardiness and inflated prices because of higher distribution costs.

According to a recent University of California study, the daily battle with traffic raises drivers' blood pressure, lowers their frustration tolerance, and fosters negative moods and aggressive driving. The results are not only hypertension, heart attacks, and coronary disease but accidents. Many people who choose to drive rather than walk or cycle a short distance do so partly to insulate themselves from the harshness of a street ruled by the motor vehicle.

That choice hardly exists in developing countries, where private car travel is the privilege of a tiny elite. Yet many deeply impoverished countries pour precious finances into motorized transport and roads. Although these investments would seem to open the door to mass transit, few governments can also afford to provide adequate busing. Moreover, many citizens cannot pay the fare for buses. Former Brookings Institution fellow and transportation expert Wilfred Owen noted in 1985 that "many miles of roads in poor countries prove more useful for drying beans and peppers than for moving traffic."

Pedal Power

So far planners have typically sought to solve automobile-related problems with automotive solutions. Without support for alternatives to driving, however, these fixes are inadequate. For example, the catalytic converter increases carbon dioxide emissions, which contribute to climate change. And while the converter and other technologies have dramatically reduced pollution from each U.S. passenger car, rapid growth in the vehicle fleet and miles traveled have partly off-

set this progress. Similarly, several alternative fuels for cars have environmental side effects. (See "Clean Cars," page 20.)

Nor is building more roads the answer to congestion. New freeways attract more cars, as some public-transit riders switch to driving and developments spring up along the routes. Society is running out of space for automobiles anyway. Cities in the industrial world typically relinquish at least one-third of their land to motor



Two commuters in Philadelphia travel by bicycle. Every time someone bikes rather than drives, society benefits. James McGurn, in On Your Bicycle, writes that the bike "quietly challenges a system of values which condones dependency, wastage, inequality of mobility, and daily carnage."

vehicles for roads and parking lots; in Los Angeles, the amount is two-thirds.

Bicycle commuters could become an important component of an effective clean-air strategy. Bike transport could do away with the most polluting of automobile drives—short trips, when engines don't heat up enough to fire efficiently.

For longer commutes, mass transit riders might ride bicycles to the station instead of driving. "Bike and ride" is a common practice in Japan and much of Europe. It is also the most cost-effective way to reduce hydrocarbon and carbon-monoxide emissions, according to a 1980 Chicago Area Transportation analysis. Displacing car trips by giving cyclists secure parking at transit stations could reduce hydrocarbon emissions at a public cost of \$311 per ton, compared with \$96,415 a ton for an express park-and-ride service, \$214,959 for a feeder bus service, and \$3,937 for a commuter rail-carpool matching service. Carbon monoxide reductions would

MARCIA D. LOWE, a senior researcher at the Worldwatch Institute, studies alternatives in transportation and agriculture. She has been a bicycle commuter for 10 years, including one year in the People's Republic of China. This article has been adapted from Worldwatch Paper 90, The Bicycle: Vehicle for a Small Planet.

accrue at similar savings.

Bicycle commuters save money on gasoline, too. In 1986, a national campaign in the Netherlands pointed out that each motorist who switched to bikes for trips of three miles or less would save at least \$400 a year. And a 1983 study of U.S. commuters revealed that—adjusting for 1990 prices—nearly \$1 billion would be shaved off the oil-import bill if 10 percent of car commuters switched to a bike-and-ride combination.

In the Third World, cycling can also provide crucial mobility. Bicycles and rickshaws have long been used in Asian cities, improving access to vital services and creating jobs. In many developing countries, however, pedal power is less common. And rural dwellers everywhere spend much of their energy carrying heavy loads of water and cooking fuel on their heads, backs, or shoulders. According to a report from Bangladesh, “headloading” accounts for half the broken necks incurred there.

Intermediate Technology Transport, Ltd., a London-based agency that gives technical assistance to local development projects in the Third World, has conducted field studies on bicycling. These show that “travel capacity,” a combination of speed and payload, is at least five times greater for people with bikes than for people who simply walk. Attaching a trailer to a bicycle allows a rider to comfortably carry up to 440 pounds—several times the maximum headload.

Cycling Societies

What sets apart the handful of countries that, in a world seduced by automobiles, have embraced the bicycle? Rutgers University associate professor of urban planning John Pucher has done a study of transport systems in 12 North American and Western European

countries. His research confirms that people’s transport decisions are not chiefly influenced by levels of income, technology, urbanization, or differences in terrain or climate. Instead, strong government support for bicycling makes the difference.

Decades ago Chinese authorities started mass-producing bicycles and building roads for nonmotorized travel. Today, special bicycle avenues with five to six lanes are common in Chinese cities. Three-track roads separate motorized traffic from pedestrians and cyclists, and some cities set apart space for load-carrying bicycles. Convenient guarded bicycle parking is plentiful. City governments also relieve pressure on overcrowded buses by paying commuters a monthly allowance for cycling to work.

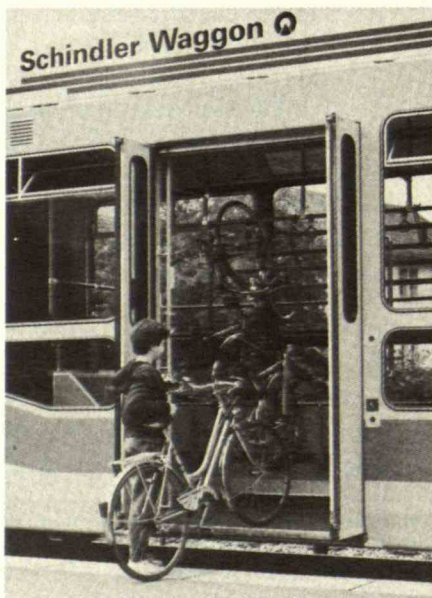
Biking is so common in China that traffic monitors at an intersection in the northern industrial city of Tianjin once counted more than 50,000 bicycles passing in one hour. Domestic bike sales in 1987 reached 35 million—surpassing total worldwide automobile sales.

Japan is another cycling society in which bicycle trips for practical purposes far outnumber those for sport. Census figures for 1980 show that 15 percent of all Japanese commuters rode bicycles to work or rail stations. National legislation passed in 1980 empowers local governments to require that railways and private businesses build ample bicycle parking, partly funded by the central government. Today there are more than 8,600 such bicycle parking sites, with total capacity for 2.4 million bicycles. Spaces are common at apartment complexes and in recreational and shopping areas as well. Limited land space in urban Japan has even inspired bicycle parking towers, in which automated cranes park thousands of bicycles. Suburban rental systems hire out hundreds of bicycles, many of which serve more than one commuter a day.

Among the several European countries where cycling is popular, the Netherlands is the most outstanding. The Dutch have long bicycled for both recreation and everyday transportation. Although the bicycle’s role declined as more people bought cars in the 1950s and 1960s, cycling resurged with the energy shocks and environmental crises of the 1970s. Between 1975 and 1985 the national government spent \$230 million to expand bicycle parking at rail stations and to construct cycleways. Whenever possible, the Dutch have built direct, uninterrupted cycling routes to make riding practical. As in other parts of the continent, pedestrian-only streets and reduced speed limits are common in Dutch towns, and car parking is prohibited in many areas.

In Malang, Indonesia, rickshaws are prominent in street traffic. They are important to transportation in many Asian cities and provide a decent living for their drivers as well. Yet governments are often hostile to these services, probably because they supposedly make cities look backward.

In Basel, Switzerland, a boy boards a bus equipped with a bike rack. Such accommodations make bike commuting over long distances possible.



Residential streets are often transformed into *woonerven*—"living yards" with low speed limits and physical barriers such as sharp curves or landscaping to discourage fast driving. All means of transport are allowed in a *woonerf*, but bicyclists and pedestrians have priority and cars enter only as "guests."

The Netherlands' closest cycling peer is Denmark. Here 20 percent of personal trips are made by bicycle and 75 percent of the major roads have cycle tracks. Like the Netherlands, Denmark has sought to tame the automobile by taxing car ownership and use. Gasoline



prices are among the highest in Europe, and the Danish Ministry of Transport points out that the 186 percent sales tax on new cars is like paying for three cars and getting only one. By contrast, the U.S. sales tax is only 5 percent.

North America's version of a cycling society is the bicycle-friendly university town, such as Palo Alto, Calif. Since 1980 that community has spent roughly \$1 million, mostly in state funds, on bicycle lockers and racks, bike bridges, and lighted cycle paths. All road patching must adhere to high standards for smoothness. The city has installed bicycle-detecting sensors—clearly marked so that cyclists can easily activate them—that change traffic lights. The centerpiece of Palo Alto's 40-mile system of bikeways is its bicycle boulevard, a two-mile stretch in the middle of town where bikes are the only through traffic allowed. The boulevard is the first segment of a larger network planned for the city center.

Palo Alto also pays its employees seven cents a mile for business travel by bicycle, maintains a police bike squad and a traffic school for juveniles who violate bicycle laws, and funds an on-road cycling course for middle-school students. A 1978 ordinance requires all new developments except single-family homes to provide secure bicycle parking, while a 1983 law calls for new office buildings 10,000 square feet or larger to provide showers for employees. Several large employers in Palo Alto add their own incentives. Alza Corp., for example, pays bicycle commuters \$1 each day they ride to work.

PHOTO: PAULA LERNER



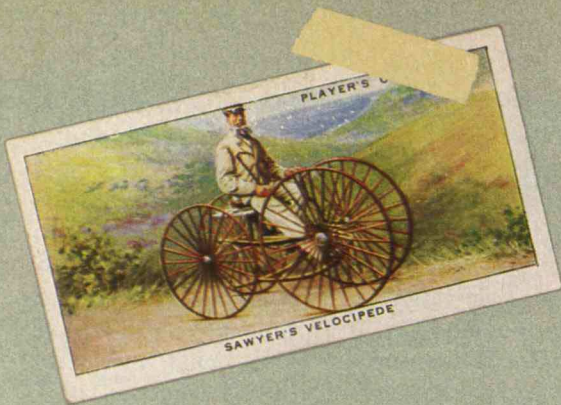
NUMBERS OF BICYCLES AND AUTOMOBILES, CIRCA 1985

Country	Bicycles (MILLIONS)	Autos (MILLIONS)	Bicycle/ Auto Ratio
China*	300.0	1.2	250.0
India	45.0	1.5	30.0
South Korea	6.0	.3	20.0
Egypt	1.5	.5	3.0
Mexico	12.0	4.8	2.5
Netherlands	11.0	4.9	2.2
Japan*	60.0	30.7	2.0
West Germany	45.0	26.0	1.7
Argentina	4.5	3.4	1.3
Tanzania	.5	.5	1.0
Australia*	6.8	7.1	1.0
United States*	103.0	139.0	.7

*1988

A comparison of bicycle and automobile ownership illustrates the extent to which different countries rely on bikes for transport. Although the United States has more than seven times as many bicycles per person as India, they play a much more modest role. That's because the ratio of bikes to autos is so much lower in the U.S.





CYCLING AS A SHARE OF DAILY PASSENGER TRIPS

City	Percent of Daily Trips
Tianjin, China	77 ¹
Shenyang, China	65
Groningen, Netherlands	50
Beijing, China	48
Delft, Netherlands	43
Dhaka, Bangladesh	40 ²
Erlangen, West Germany	26
Odense, Denmark	25
Tokyo, Japan	25 ³
Delhi, India	22
Copenhagen, Denmark	20
Basel, Switzerland	20
Hannover, West Germany	14
Manhattan, United States	8 ⁴
Perth, Australia	6
Toronto, Canada	3 ⁴
London, England	2
Sydney, Australia	1

¹Share of non-walking trips.

²Trips by cycle rickshaw only.

³Share of cycling or walking to work.

⁴Vehicle trips (versus passenger trips; each vehicle may carry more than one passenger)

Both industrialized and developing countries support major cycling societies. Government backing seems to be the key, not geography or climate.



Getting There from Here

As the world's cycling societies demonstrate, bicycle transportation can become an everyday alternative. What's needed are both public support and private initiatives, from international institutions to individual commuters. National governments could make auto users pay more of the full costs of road building and maintenance, police, fire, and ambulance services, and the health care associated with accidents and air pollution. In the United States, the hidden price of car driving may total as much as \$300 billion each year.

Governments can counteract this enormous subsidy by taxing auto ownership and use. In John Pucher's study, it is clear that the more drivers are taxed, the less they drive. Of the countries in the study, Denmark and the Netherlands—the two with the highest taxes—also have the lowest per capita figures for automobile travel. The United States comes in last in both sales and gasoline taxation, and is second only to Sweden—the country with the next-to-lowest gasoline tax—in distance traveled per person.

According to Pucher, U.S. citizens do not drive more because of wealth; 7 of the 10 European countries in the study had higher per-capita incomes in 1980. Greater distances and more urban land sprawl account for some of the difference. Perhaps most important is the relative scarcity of mass transit in the United States—as little as a quarter of that in other countries in the study, measured on a per-person basis.

Levying user fees for parking and road space can also help. In the United States, 75 percent of all commuters park at no cost. Local bans on free parking in Japan and Europe encourage drivers to bike and take mass transit instead. Singapore charges private cars carrying fewer than four passengers "congestion fees" for entering the downtown area during rush hours. Since 1975 the scheme has decreased the number of cars so much that traffic accidents have dropped 25 percent, and fuel consumption has fallen 30 percent.

As the world's cities and suburbs rapidly grow, adding bike-and-ride facilities will become an important alternative to expanding automobile park-and-ride lots. Bicycle racks and lockers cost much less to provide than car parking, which requires at least 20 times as much space.

Thirty-three U.S. states included measures to promote bicycles in their plans to implement the Clean Air Act of 1970. For example, in Los Angeles and other western cities, "trip reduction ordinances" require major employers to reduce the ratio of motor vehicles to commuting employees. These regulations suggest adding bicycle parking and employee shower facilities. Other states are expected to add similar measures after the act's 1990 revisions. Requiring amenities like bicycle lockers and offering incentives to use mass transit are



Bicycles have a broader array of uses than might be imagined. Starting clockwise from above: Even other cyclists in Gwang Xi, China, are surprised to see one bike hauling so much cargo. In Seattle, police on bikes search a suspected drug dealer. A bicyclist in Basel, Switzerland, carries a load of plants. A "rural ambulance" brings a Kampuchean to Kompong Speu hospital. In Copenhagen, the Royal Guard trains with bicycles.





ENERGY EXPENDED BY DIFFERENT FORMS OF TRANSPORT IN THE UNITED STATES, 1984

Transport Mode	Calories per Passenger Mile
Automobile, 1 occupant	1,860
Bus	920
Train	885
Walking	100
Bicycle	35

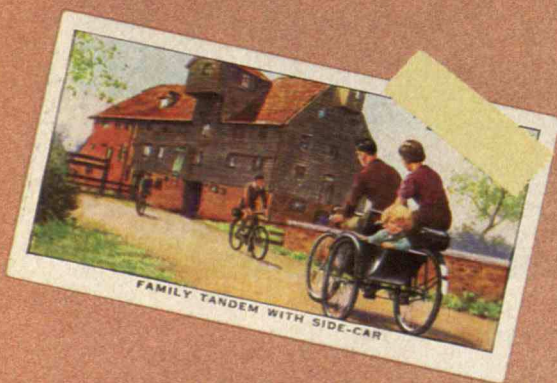
NUMBER OF PEOPLE ONE METER-WIDTH OF LANE CAN CARRY PER HOUR

Transport Mode	Operating Speed (MILES PER HOUR)	People
Auto in mixed traffic	9-15	120-220
Auto on motorway	37-43	750
Bicycle	6-9	1,500
Bus in mixed traffic	6-9	2,700
Pedestrian	2.5	3,600
Suburban railway	28	4,000
Bus in separate busway	22-28	5,200
Surface rapid rail	22	9,000

Source: United Nations, *Transportation Strategies for Human Settlements in Developing Countries*, 1984.

Bicycles consume less energy per passenger mile than any other form of transport, including walking. And they can also move more people per hour than an automobile at the top of its operating speed. For long trips, a combina-

tion of cycling and mass transit saves the most space on the road. In the second table, the ranges account for road conditions and the average number of people that vehicles carry in developing as well as industrialized countries.



concrete ways to make these steps work.

For their part, local governments could devote a specific portion of downtown parking space to bicycles, and allocate a percentage of all transport spending to building cycleways. Safe access to these routes needs to be included, in addition to bicycle underpasses and bridges across dangerous intersections. Reducing traffic speed on roads reduces risks where limited space makes physical separation impossible. Finally, traffic authorities could improve cyclists' safety at little cost by removing debris and modifying wheel-trapping drain grates on regular streets.

Safety education for cyclists and law enforcement for both auto and cycle offenders is especially important. In Manhattan, where bike-pedestrian accidents have declined each year since 1985, the credit has gone to both an increase in police summonses to cyclists and an emphasis by cycling organizations on mutual responsibility and cooperation.

Metropolitan areas could serve their own long-term interests by adopting regional growth plans that limit urban sprawl. Land use should be designed to emphasize mass transit and cluster homes together with shopping and workplaces.

Policymakers in developing countries could expand transport at little cost by better supporting bicycles and rickshaws. City governments are often hostile to rickshaws and similar services, either discouraging them with regulations, fines, and taxes, or wiping them out through bans and confiscations. For example, the city of Jakarta, Indonesia, has confiscated 100,000 cycle rickshaws over the past several years and dumped them into the sea, supposedly to reduce traffic congestion. Although governments typically declare rickshaws unsafe or inhumane, the more likely motive is to clear the streets of vehicles that supposedly make the city look poor and backward. Rickshaws not only account for a significant proportion of trips in many Third World cities, but can provide a good income for their drivers. Unnayan, a Calcutta advocacy group, calculated that in 1980 a rickshaw driver earned nearly \$300 a year, well above the average income.

A humane way to relieve the drudgery of rickshaw driving would be to improve the design of both streets and the vehicles themselves, according to South Asian urban transport authority V. Setty Pendakur of the University of British Columbia. Inter Pares, a Canadian agency, is redesigning rickshaws originally developed with six-foot Europeans in mind. The new vehicles are lighter, cheaper, and more maneuverable for the typical five-foot Bangladeshi driver.

Building low-cost roads meant chiefly for nonmotorized vehicles is another important priority for develop-

Bicyclists travel on a road near Wawa in northern Nigeria. Below: Paperboys ply their trade in Mexico City.



ing countries. These roads, which are made without expensive imported equipment, are narrower than regular roads and have a surface of packed dirt rather than blacktop. A World Bank-assisted project in Ghana involves constructing such roads in rural areas. Sufficient to serve an occasional truck or car, the roads can be built for roughly 8 percent of the cost of a conventional rural road.

Third World governments could also foster domestic bicycle industries. In Africa and Latin America, the few bikes available are often of poor quality, while spare parts are scarce and maintenance skills are inadequate. Starting a bicycle industry is a relatively low-risk venture. A small assembly plant and repair shop can run on about \$200 worth of tools, and 100 bicycles can be manufactured for the energy and materials it takes to build a medium-sized car.

India has demonstrated how a nearly self-sufficient bicycle industry can be created by first assembling bikes with imported parts, then producing frames in local workshops, and gradually establishing small factories to manufacture parts domestically. From a modest beginning five decades ago, India has become a major world producer. Through joint-venture and license agreements, it is now sharing its techniques with countries in Asia, Africa, and the Caribbean.

Convincing governments to act will probably require a concerted effort from cycling advocacy organizations. In Denmark, much of the extensive network of cycling lanes can be credited to the Danish Cyclist Federation, which pressured authorities to accommodate cyclists with special facilities and traffic management. And con-

sider the effect biking messenger services and other groups had when Mayor Edward Koch announced in 1987 that New York City's three main avenues would be closed to bicycles on weekdays. The groups demonstrated against the ban, took legal action to reverse it on a technical flaw, and finally persuaded the mayor not to try banning bicycles again.

On the national level, however, U.S. cyclists have a long haul ahead. Although last summer Transportation Secretary Samuel K. Skinner pledged to national cycling organizations that he would consider including cycling in the nation's transportation policy, bicycles are in fact only given lip service in the recently released plan.

As societies gradually see the potential of bicycling, a new scenario comes into view: a diverse transport system that does not harm the environment, demands little from the economy, and gives crucial mobility to millions of people. Getting there will first require looking beyond entrenched transport solutions. ■



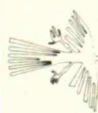


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THE CULTURE OF TECHNOLOGY

LANGDON WINNER

The Electronic Beehive

IT was about a year ago that someone first asked for my fax number. What an embarrassment it was to confess that I didn't have one. Since then, without my ever having chosen it, faxing has subtly forced its way into my daily routine. Faxes come in and faxes go out with a digitized urgency that whispers "no time to spare."

The fax machine is, of course, just one weapon in the bulging arsenal of electronic communication tools. Telephone answering machines, beepers, cellular phones, laptop computers, and other electronic wonders all promise to save time and make us more productive. But these benefits, if they ever materialize, come at a cost. Corners of our lives once sheltered from direct technological intervention are now bombarded by the demands of incoming and outgoing messages.

Society is beginning to look like a vast electronic beehive, in which information processing in search of economic gain overshadows other personal and social goods. Restaurants, for example, used to be havens where one could sit down for a peaceful meal and quiet conversation. But in our larger cities, many customers now take cellular phones to their tables, handling calls just as they would back at the office. Does this mean we will have



*Our obsession with
instant communications
robs us of leisure time and
diminishes the depth
of our ideas.*

to get used to public spaces—shops, taverns, theaters, galleries—filled with people chattering on portable communication systems? Would you prefer the phoning or non-phoning section?

The automobile is undergoing a similar transformation. Drivers once used their road time to talk to passengers, listen to music, gaze at the scenery—or just think. But cellular phones and car fax machines have made such moments seem woefully unproductive. How much more efficient it is to sail down the highway in a multimedia center, making deals, checking the

stock market, or updating one's calendar. Says a Los Angeles entertainment executive quoted in the *Wall Street Journal*: "I can't drive and enjoy the radio. I have to be on the phone."

Throughout the twentieth century, each new labor-saving device has encouraged us to think we'd soon be liberated from toil, free to move on to more creative and enjoyable pursuits. Such dreams have always been frustrated. Yes, our available time expands, but much of it is absorbed by the frenetic interactions that our new machines encourage and our working lives demand.

A standard that seems to be winning credibility is that if a message *can* move quickly, it *must* move quickly. Information that could just as well have come by U.S. mail arrives in seconds. In December I received a number of faxes, includ-

LANGDON WINNER teaches in the Program on Science and Technology at Rensselaer Polytechnic Institute. His most recent book is *The Whale and the Reactor*.

Continued on page 78

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ROBERT K. ADAIR

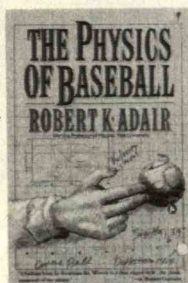
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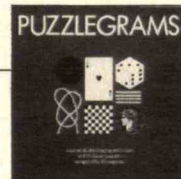
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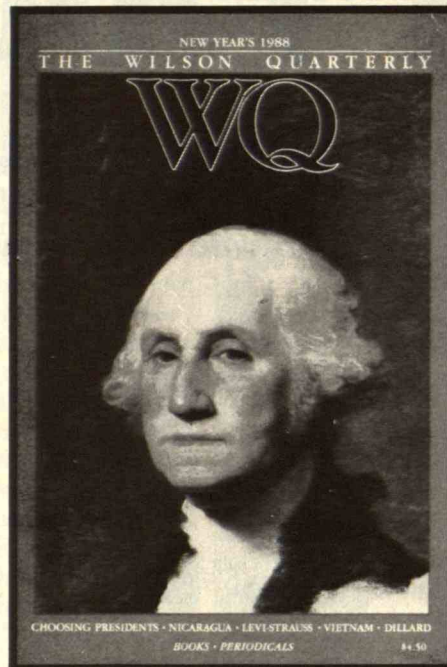
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Research Endangered

AN incomparably exciting moment comes for a budding scientist when he or she first experiences the ineffable pleasure of discovery. This pleasure comes with the realization that not only are there still great voids in our understanding of the universe, but that by finding the growing edge of human knowledge you can personally create the platform from which to conquer new pieces of that void.

My seminal epiphany came as a high school student working in a summer program of the Jackson Laboratory in Maine. These experiments involved the genetics of pigmentation and blood cell formation in mice. I was lucky enough to reverse the usual chain of events—I discovered discovery before I had much knowledge of contemporary biology—and had to spend the next years imbibing history so that I could put new revelations into an established context. Clearly, the allure of investigation has the power to capture even the uninitiated.

Once stirred by the cerebral intoxication of discovery, the scientist learns that although this pursuit is legally and morally sanctioned, it is also very expensive. Because science is both culturally enriching and technologically generative, the government has been picking up the tab since World War II.

For years, research money seemed



*Uncertain funding
undermines the joy
of discovery.*

limitless. In the 1960s and 70s, the ratio of funds to practitioners in biomedical research was so high that research addicts like me experienced their pleasure unalloyed with concerns about how to pay. As opposed to most addictions, here society was the beneficiary: the recombinant DNA methods that have revolutionized biology and generated modern biotechnology were a product of these times.

Today, however, young students who develop the skills for leading

edge research face a very different prospect. The money seems to be drying up. The elders of the field speak not of the pure glories in a life of discovery but of the attendant drudgery of finding money and dealing with regulations. Overall there is a 15 percent reduction in the funding of new grants, all of this at a time when molecular biology has provided powerful new avenues of attack on the diseases that afflict us as well as clues to solve the biological puzzles that perplex us. Even with increasing non-governmental funds from organizations such as the Howard Hughes Medical Institute, research money is much scarcer than it was even five years ago.

The uncertainty of funding threatens to drive excellent people from the field. The excitement remains: I see students energized to immerse themselves in round-the-clock research, the type of addicts who make the important discoveries. But I also see junior faculty, just a few years older, worried and uncertain about their future.



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DAVID BALTIMORE, a Nobel laureate, is director of the Whitehead Institute for Biomedical Research and professor of biology at MIT.

Continued on page 78

Reviews

BOOKS

HOW THE WEST MISJUDGES THE REST

Machines as the Measure of Men: Science, Technology, and Ideologies of Western Dominance

by Michael Adas

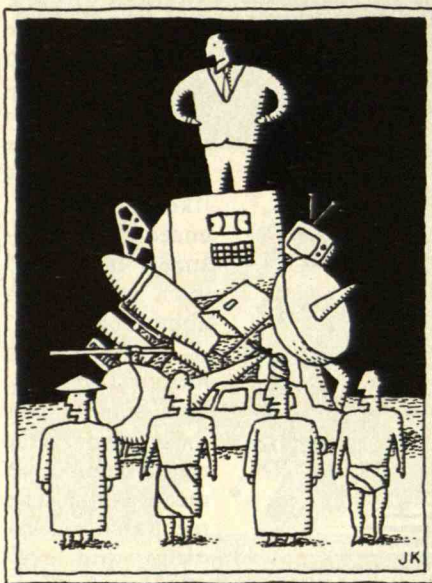
Cornell University Press, \$29.95

BY ROSALIND WILLIAMS

THE postwar world has vanished overnight, taking with it a familiar signpost: an arrow pointing boldly toward "modernization." This, we thought, was the inevitable destination of "underdeveloped" nations, whether they took the socialist road (heavy industry, centralized planning) or the capitalist one (consumer goods, market mechanisms). Today, neither looks like the royal road to stability and prosperity. Furthermore, both systems have caused massive environmental destruction that threatens the earthly sources of all economic growth.

What road, then, should "underdeveloped" nations take to move into the future? Is it possible that they will reject not only the socialist and capitalist paths, but the goal of modernization itself?

Rutgers University historian Michael Adas addresses such fundamental questions in *Machines as the Measure of Men: Science, Technology, and Ideologies of Western Dominance*. This superb and timely book traces the history of the cultural assumptions underlying economic theories of modernization: that the West is superior to the rest of the world because of its technological accomplishments, and that those accomplishments provide a universal and objective measure of human value. These assumptions are so pervasive that we hardly notice them, much less question them. In a thoughtful and reasonable way, Adas encourages us to do both.



The History of a Fallacy

From the beginning of the Old World's "discovery" of new worlds, most Europeans have taken their own cultural superiority for granted. But their yardsticks have gradually changed. In the sixteenth and seventeenth centuries, scientific and technical achievement was only one of many standards by which Europeans rated themselves against other societies. They also considered physical appearance, social customs, political organization, and above all religion. In 1700, China was widely honored in Europe—not only for its accomplishments in textile and porcelain manufacture but also for its social order, agriculture-based economy, and decorative arts. The court of Louis XIV ushered in the new century with festivities at Versailles performed in what the French considered Chinese style.

During the eighteenth century, however, European measures of superiority more and more focused on science and technology. This yardstick most favored the "discoverers." As it became paramount, the other accomplishments of China, India, and sub-Saharan Africa—the three areas Adas discusses—were more and more disparaged. By 1800, Europeans routinely dismissed China as economically stagnant, social

ly corrupt, and scientifically backward.

What had changed since Louis XIV was not so much China itself as Europeans' definition of civilization. By 1800 many Western "experts" on the non-Western world were natural scientists, colonial administrators, and social theorists—self-made men for whom scientific and technical training had been a route to success. Such men projected their own experience onto the rest of the world. They assumed that material self-improvement was a universal goal, and that science and technology were the self-evident ways to achieve it.

By 1900, the criteria for judging other cultures had become even narrower. Where science and technology had once been treated as distinct enterprises, they now were often lumped together. The source of European pride had become applied science and the material goods it produced. And where societies had once been rated on a graduated scale, they were now divided into traditional versus progressive, East versus West, and (even though Adas argues that Europeans justified imperialism with material arguments more than racist ones) colored versus white.

Which brings us to our own century. As Adas notes, "national liberation and civil rights struggles and Nazi atrocities have done much to discredit racist arguments" for Western superiority in the twentieth century. Arguments based on material superiority have had considerably more staying power.

This has been especially true in the United States. Europe's conviction of its cultural superiority began to weaken in the early 1900s, when Japan emerged as an industrial power. That conviction barely survived World War I, in which Europe nearly destroyed itself with its industrial prowess. But Adas proposes that the "spell . . . of mastery" still enchants Americans.

One reason is that the United States entered the Great War late and lost relatively few soldiers (fewer than in Vietnam). Other reasons lie deeper in U.S. history. From earliest colonial times, for example, settlers used arguments of cul-

tural superiority to justify taking land away from Native Americans.

Adas argues that the Third World "modernization" policies the United States adopted after World War II arrogantly assumed the superiority of a technology-based Western "way of life." All too often, he says, these self-serving policies justified economic and political domination over "underdeveloped" countries. Postwar modernization became a technological version of manifest destiny.

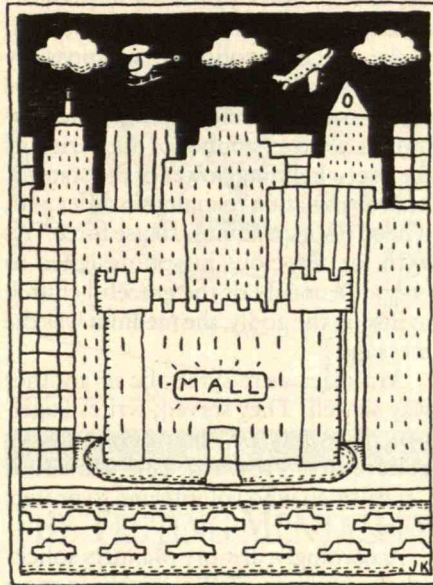
Alternate Routes to Development

Today, as Third World nations try to chart an independent destiny, they find themselves in a double bind. To modernize along either Soviet or Western lines would be disastrous in ecological terms, and perhaps in social ones as well. But not to modernize could be disastrous too, because these nations need to support burgeoning populations.

Adas suggests that Third World societies may fare better with what are usually called appropriate technologies than with "the scientific-industrial model in either its Western or its Soviet guise." Appropriate technologies "have often proved better suited to the actual needs and socioeconomic conditions in developing areas than programs oriented to large-scale, capital-intensive projects."

Adas stresses that "modernized" nations too must rethink their concepts of human worth if they are to avoid suicidal pollution and debilitating social tensions. All the debates about creating a U.S. industrial policy seem trivial next to the question Adas raises: should technological mastery of the material world be the ultimate standard of human value? His book shows that while that standard is deeply rooted, it is a product of history rather than an eternal truth. ■

ROSALIND WILLIAMS is an assistant professor in the MIT Writing Program and the author of *Notes on the Underground: An Essay on Technology, Society, and the Imagination* (MIT Press, 1990).



BOOKS

URBAN CASTLES

*America's Armories:
Architecture, Society, and Public Order*
by Robert M. Fogelson
Harvard University Press, \$30.00

BY JANE HOLTZ KAY

BORN to glory, the National Guard armories that sprang up across the United States between 1880 and 1930 are often reduced to a mundane fate these days. In my own urban meanderings, I have gone to antique shows in their hollow halls, looked at displays of contemporary art slightly askew on their walls, spent a snowy Maine winter evening in a hotel housed within one, and even waited patiently while my daughter got her driver's license in just such a formidable fortress—while only vaguely suspecting that their origins lay in class struggle.

Robert M. Fogelson, a professor of urban studies and history at MIT, explains these origins in *America's Armories: Architecture, Society, and*

Public Order. His social and architectural history transforms the armory, with its medieval towers, turrets, and moats, from a mere oddity into an index of a tumultuous period. The armory emerges as a form that is fascinating on many counts: not only as one of our most elegant and heretofore unexplored public buildings but as a manifestation of upper-class fears about political and labor violence.

A Warning to the Great Unwashed

The draft riots of the Civil War era inspired fears of "mobocracy," Fogelson writes, and the postwar labor disputes seemed to be "the harbingers of even more severe industrial strife." Quelling "the restive spirits of license," as accounts of the period put it, would demand more than municipal police. But it was the railroad strike of 1877 that launched the construction of armories. It generated riots so bloody and destructive that President Rutherford B. Hayes allowed railroad managers to use federal troops.

Property owners, sure that such episodes were a prelude to Armageddon, put pressure on elected officials to stop insurrection and maintain order at any cost. Because city police forces were limited and the federal government didn't want to maintain a large peacetime army, an expanded National Guard seemed to be the answer. Campaigns were launched to attract volunteers and raise money for building them comfortable quarters. "There must be an armory or there will be no soldiers," declared New York State Adjutant-General Josiah Porter. With commanders like Porter at the helm and plutocrats like William H. Vanderbilt, the railroad baron, at the till, recruitment and fundraising proceeded in almost every state.

The armories' design reflects the threat perceived by those who commissioned and built them. "The conditions," wrote Burnham and Root, the architects of Chicago's First Regiment Armory, "are practically identical with those which caused the building of

mediaeval castles, and the design . . . being thus caused by analogous conditions, is strongly suggestive of a fortress." Another architect described the armory as "a building which should be held against any mob."

To that end, armories were girded by stone walls 13 feet thick and surrounded by moats. The stout iron bars on the drill shed of New York's Seventh Regiment Armory—which were typical—would have held off the Huns. The entrance of one armory, writes Fogelson, was "protected by a portcullis of chains and steel bars," and the basement was "so amply provided with gates, bolts and locks that any attempt to force an entrance would be practically an impossibility."

This may seem an excessive defense against an opponent that was likely to

be, in Fogelson's words, "a mob of ordinary citizens, armed, if at all, with rocks, bricks, handguns, and possibly muskets and rifles." But the might was emblematic as well as pragmatic. Armories were a "symbol of authority, of the overwhelming power of the state, of its determination to maintain order and, if need be, its readiness to use force." As with the ferocious prison designed to warn the unruly or the graceful church to inspire the godly, the medium was the message.

Armories were symbolic in another way as well. They served, writes Fogelson, as signs of the "community's generosity" toward the National Guardsmen who volunteered to protect them.

Accordingly, armory planners solicited the services of the country's most

prestigious architectural firms. Burnham and Root, for example, had designed the 1892 World's Fair in Chicago, as well as some of the city's first skyscrapers. Like most armories, the firm's First Regiment Armory provided splendor within as well as without. Surrounded by carved oak walls, the National Guardsmen enjoyed such amenities as officers' rooms, company rooms, trophy rooms, libraries, and saloons, even swimming pools and bowling alleys.

In fact, armories only occasionally served the defensive purpose for which they supposedly had been conceived. Most of the time, the buildings were used as drilling grounds and as social clubs for amusing the troops in their off-hours.

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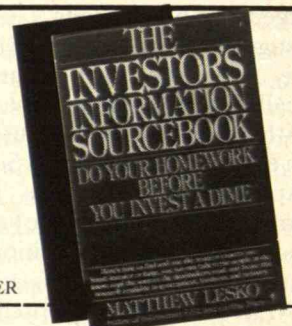
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mories were not without their opponents. The Socialist party was against them for their role in stifling labor unrest. New York's Washington Square Association didn't want so grandiose a structure and fended one off from the borders of its park. And the *Brooklyn Eagle* didn't like the cost of housing so many troops. A journalist there assailed the National Guard with a quote from Sir Walter Scott's poem on the English militia: "Mouths without hands, maintained at vast expense. . . . In peace a charge, in war a weak defense."

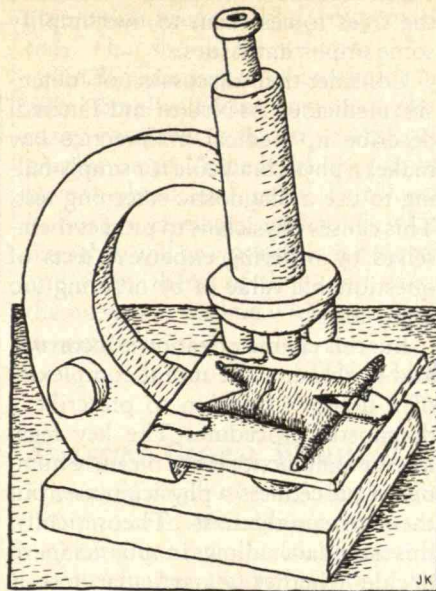
Ignoring the Visual

Fogelson does a good job of exploring armories' function and historic meaning. Where design writers once shunned such matters—concentrating singlemindedly on aesthetics—*America's Armories* is part of a trend toward a broader socioeconomic approach to architecture.

Nonetheless, Fogelson skimps on design. Visual elements preoccupied architects and their clients alike in that more visual age. Yet the author barely acknowledges that the armory's stylistic kit of parts—here a seigneurial turret, there a manorial iron grille—reached heights of excellence. And he gives only a cursory nod to five armories by H.H. Richardson, the nineteenth-century genius of design, failing even to mention their whereabouts. The publisher compounds the author's neglect with skimpy and faded photographs.

From his sociological vantage point, Fogelson is adept at pointing out historical ironies—for example, that some armories have come full cycle to hold the homeless, the very outcasts they were built to ward off. But he ignores the visual irony: the transition of a building form from an awesome citadel to a charming and somewhat inscrutable artifact. ■

JANE HOLTZ KAY, architecture critic for *The Nation* and a design columnist for the *New York Times*, is author of *Lost Boston* and *Preserving New England*.



BOOKS

THE TESTING MENTALITY

Dangerous Diagnostics:

The Social Power of Biological Information

by Dorothy Nelkin and Laurence Tancredi

Basic Books, \$18.95

BY ALAN STRUDLER

EVERY year, about a million people undergo back x-rays as part of a routine physical when applying for a job. By weeding out applicants with back problems, companies avoid the costs of future work-related injuries. However, studies have shown that only about 2 percent of the individuals disqualified by the x-ray subsequently develop serious back trouble. What companies see as an efficient way to limit their liability is for the individual an unfair obstacle to employment.

This is only one of many examples of the social uses of biological information that Dorothy Nelkin and Laurence Tancredi discuss in *Dangerous Diagnostics*. This brief but powerful book addresses what the authors consider an American obsession with testing for biological disorders and traits. Nelkin and Tancredi discuss a daunting variety of diagnostic procedures—IQ tests, AIDS tests, electrocardiograms, and techniques that identify genetic markers for

hereditary diseases or diagnose neurological and behavioral disorders, to name a few. And they trace the social impact of testing on a wide range of institutions, including schools, courts, insurers, health-care providers, and private employers.

According to the authors, the increasing reliance on such tests is driven by cultural values rather than the accuracy of the tests. One such value is economic efficiency, as the x-ray example suggests. Another is a simplistic notion of scientific objectivity.

Take the growing reliance on algorithms in medical diagnoses. An algorithm is a set of instructions that tells a physician exactly what to do when confronted with a particular problem—for example, when a patient makes a specific complaint or shows a distinctive symptom. Because algorithms are precise and rigorous, their interpretation seems objective. Physicians depend on them to prevent their own biases from intruding into the diagnostic process.

But the authors point out that algorithms are also rigid. In complex diagnoses, relying on them may lower a physician's sensitivity to "the complex and interconnected variables relevant to understanding disease." A superficial objectivity replaces subjective judgment that may be more medically appropriate.

Enthusiasm for testing, Nelkin and Tancredi argue, has serious social costs. In particular, it creates skewed concepts of "normality" and "good health" that can be used to discriminate unfairly. Schools that fail to educate their students escape blame by pointing to test results emphasizing the students' mental or emotional defects. Employers avoid the cost of providing safe working conditions by using tests to exclude "unhealthy" people from the workplace. Thus, vulnerable people are treated as sick, so that institutions appear healthy.

Throughout *Dangerous Diagnostics*, Nelkin and Tancredi show persuasively that the problems they examine represent a broad tendency. But their de-

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TECHNOLOGY DAY 1990

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REVIEWS

cision to focus on the forest rather than the trees forces them to oversimplify some important issues.

Consider their discussion of "defensive medicine." As Nelkin and Tancredi describe it, medical malpractice law makes a physician liable for simply failing to use a diagnostic screening test. This causes physicians to protect themselves by ordering expensive tests of questionable value or by ordering too many tests.

But this characterization is incorrect, and it obscures the moral complexity of a doctor's decision to prescribe a diagnostic procedure. The key legal test for malpractice is not the mere number of procedures a physician uses but their reasonableness. Theoretically, this standard allows a physician to decide whether a particular test is appropriate.

How juries interpret reasonableness, however, is highly uncertain. So even while physicians know that they face no liability so long as their decision not to test is found reasonable, they often order extra tests to avoid falling prey to an unpredictable jury. If the problem is the uncertainty of liability judgments, rather than simply their increased incidence, then the question of how to limit that unpredictability may be more important than the question of how to limit the number of cases filed and the amount of damages paid.

A different sort of oversimplification appears in the authors' discussion of DNA fingerprinting. In this method of identifying criminals, genetic material is typically taken from a suspect and compared with genetic material recovered at the scene of the crime. Nelkin and Tancredi rightly worry that juries may become too dependent on such evidence. But they never explain why this is dangerous. The reason is that DNA fingerprinting can be highly misleading.

Still, the oversimplifications of *Dangerous Diagnostics* are more than compensated for by its power to provoke thought. Nelkin and Tancredi shed light on the unexamined assumptions that shape social attitudes toward diagnostic testing. ■

ALAN STRUDLER is a research scholar at the University of Maryland's Institute for Philosophy and Public Policy.

WINNER/CONTINUED

ing some from overseas, wishing me a "Merry Christmas and Happy New Year." A friend recently sent out letters to a group of philosophers asking for ideas for a conference to be held two years from now. Of the sixteen who responded, fifteen did so by fax. The philosophers, of all people, would do well to ponder: What's our hurry?

As this fashion spreads, high-tech gadgets that at first seemed optional end up being compulsory. If technologies make it possible to reach you, then you have an obligation to remain accessible. People get annoyed if they sense that you are disconnected from the electronic pulse even for a short time. The desire to do things faster and faster eventually destroys the possibility that we might work without haste.

Yet quality takes time. Our embrace of high-tech gadgetry could turn life into a series of rushed encounters and clipped exchanges, producing ideas of diminishing depth. In our enthusiasm for electronic immediacy, we should take care to preserve the quiet places in our lives where genuine productivity and satisfaction dwell. ■

BALTIMORE/CONTINUED

More federal research money would help. Perhaps more importantly, we should examine the way that this money is allocated. An increasing fraction of the National Institutes of Health budget goes to satisfy political goals: funds are channeled to satisfy pressures for uniform geographical distribution, and new institutes, such as one devoted to deafness, are opened within the NIH because of special-interest lobbying efforts. Moreover, too much money is tied up in large block grants that fund research centers, leaving less to fund individual research institutions. The government science structure should be devoted to finding and funding the most exciting and effective investigators.

The situation is getting desperate. Even the National Research Council worries that, should present trends continue, there will be too few investigators to take advantage of the opportunities being opened in biology. Unless we make research the attractive enterprise it once was, we are in danger of losing one of the most golden of egg layers—the young, creative scientist. ■

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LETTERS/CONTINUED

engineering school diploma and your accomplishments establish your credentials. That should be sufficient.

Finally, licensing would make life unduly complicated for engineers, since many routinely work in several geographic areas. To be legal, they would have to obtain and renew their license in dozens of states, anticipate which ones they will be working in for months and years ahead of time, and devote themselves to dealing with bureaucratic agencies.

STAN JAKUBA
West Hartford, Conn.

ASSESSING GLOBAL WARMING

I breathed a sigh of relief after reading that the ocean surface temperature and night marine air temperature haven't risen since the late 1800s ("Has the Globe Really Warmed?" *TR November/December 1989*)—relief that the globe isn't warming after all. Next came skepticism.

In high school we learned that a beaker of ice and water will stay at 32°F until all the ice melts. Also, stirring the mixture was shown to speed melting by increasing heat exchange at the air-water interface. Since our earth has two big polar ice caps and a significant amount of natural stirring in the form of ocean currents, it seems that measuring the water temperature will not tell us anything about global warming until all the ice melts. We would probably do better to measure the change in the rate at which the ice caps are melting and monitor any alterations in ocean currents.

CARL BORCHERT
Nantucket, Mass.

CORRECTION

"Making Math Education Work" by Kenneth Hoffman and Lynn Arthur Steen (*TR November/December 1989*) states that "doubling the dimensions of a square results in an area four times as great, while doubling a cube produces a volume eight times larger . . . Dimension reflects the doubling exponent: 422, 823." The numbers should have read "4=2², 8=2³."



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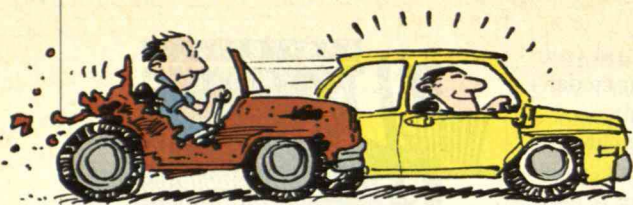
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Notes



Hard Bodies

The metal in cars is holding up better these days, according to a study presented to the Society of Automotive Engineers. Comparing a sample of cars in the Detroit area to similar samples five and six years ago, the study found a 31.3 percent reduction in the number of vehicles with visible corrosion. Paint blisters were down 45 percent, and vehicles with surface rust were down 41 percent. Perforated body panels appeared in 86 percent fewer vehicles.

Beach Bummer

Texas, with 3,549 pounds of debris per mile, has the nation's most littered beaches, reports the Center for Marine Conservation. The D.C.-based group says that Mississippi is No. 2 with 3,000 pounds, followed by Louisiana with 2,337 pounds. At 95 pounds per mile, Connecticut tops the 25 states and territories studied.

The figures come from the center's 1988 survey, when 47,500 volunteers cleaned up 3,500 miles of coast. The volunteers collected nearly 1,000 tons of garbage, of which 61 percent by volume was plastic—including styrofoam, six-pack rings, and tampon applicators.



Air Express

For mail carriers, modernization has replaced horses with motorized vehicles, and that's about it. Carnegie Mellon Research Institute (CMRI) thinks it can help the post office go farther.

Usually, carriers sort mail into pigeon holes, put the mail into trays, put the trays into a laundry hamper, and wheel the hamper to a loading dock. There, carriers bend to take the trays out and put them into a truck, where the mail is sorted into delivery order.

CMRI's prototype aluminum mail-transport system rolls into the truck. Mail is handled twice: when it is put into the system's trays, and when it goes into mailboxes. In addition to faster delivery, the system should reduce back problems, since it cuts out bending and stooping.

Quasicrystals

After five years of scientific speculation, researchers at AT&T Bell Labs have confirmed the existence of "quasicrystals," a new form of matter.

For centuries, physicists knew of two types of solids: crystals and glasses. In diamonds and other crystals, atoms follow regular patterns, much like floor tiles. Glass atoms are arranged randomly. Atoms in this new form of matter have "a curious five-fold, or pentagon-shaped, symmetry," says Refik Kortan, who grew the single-grain quasicrystals.

Ordinarily, it's impossible to fit pentagons together without leaving holes in the pattern. "But in the case of quasicrystals, nature somehow blends the pentagon shapes to create regular patterns that fit together perfectly and never repeat themselves," he says.

The latest quasicrystals—made of aluminum, cobalt, and

copper—are light and hard and maintain a steady electrical resistance over a wide temperature range. Those qualities suggest many possible applications, particularly in high-quality electrical resistors and fuse links.

Saving Diversity

The United Nations Environment Programme, the World Resources Institute (WRI), and the World Conservation Union have launched a campaign to stop the greatest loss of plant and animal species since the dinosaurs disappeared. With headquarters in Africa, the United States, and Europe, the groups want to protect earth's biological diversity and genetic heritage.

According to a WRI report by Walter Reid and Kenton Miller, a quarter of the world's plant and animal species face extinction in 25 to 50 years. The rate at which birds and mammals disappear may be as much as 1,000 times higher than it would be if humans hadn't disturbed nature.

Biowar Regs Loosened

Acting on a Pentagon request, the National Institutes of Health (NIH) Recombinant DNA Advisory Committee has relaxed safety guidelines for research on two highly virulent biological agents. This will make it easier for the Army to conduct animal and insect studies on yellow fever and Venezuelan equine encephalitis virus at the Plum Island Research Facility in New York.

Molecular biologist Barbara Rosenberg of the Council for Responsible Genetics (CRG) had opposed the change, asserting "it would set a dangerous precedent for the NIH to alter research standards to fit

existing facilities." The CRG, noting that public opposition has thwarted the Pentagon's attempt to build a new maximum containment facility in Utah, says the change "appears to be an effort by the DOD to alter safety guidelines quietly through bureaucratic channels rather than through a public review process."



Toucky Genes

Stanford University scientists have identified a group of genes that are turned on by rain, wind, or a gentle touch. "Plants are able to sense or feel the wind or touch stimulation and then translate this perception into the active response of turning on genes," says co-investigator Janet Braam.

"Plants can't get up and run away from environmental stress," she says. "They have to respond . . . where they are, and one way they respond is to change their development." That's why coastal trees grow bent over.

Braam had been spraying *Arabidopsis*, a mustard-family plant, with hormones to trigger genes and found that water had the same effect. "I finally worked out that it wasn't the hormone, it wasn't the water, it was just the touch." The results were reported in *Cell*.

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